ELECTRICAL CONSTRUCTION AND MAINTENANCE

A McGRAW-HILL PUBLICATION 50TH YEAR

This new three-phase Inductrol gives you more kva of regulation in a smaller floor space than ever before.

General Electric's NEW INDUCTROLS

(dry-type induction voltage regulators)

will help you get out more production

Poor voltage can mean sluggish performance of electrical equipment—and reduced output. To be sure you are getting the motor performance and lamp brilliance you pay for, keep voltage up with General Electric's Inductrols.

New, improved Inductrols have been introduced this year for both single-phase and three-phase circuits, 600 volts and below. These new dry-type regulators automatically maintain correct voltage on your equipment. They do not require expensive fireproof vaults. The attractively styled all-steel cabinets completely enclose all live parts for greater safety. Standard automatic regulators are available for circuits ranging from 3 kva, 120 volts up to 500 kva, 600 volts.

For advice on how, when, and where to apply Inductrols, get in touch with your G-E sales representative or authorized agent.

Write for Bulletins GEC-712 and GEC-795. *General Electric Company, Schenectady 5, New York.*

404-81

GENERAL ELECTRIC

Murray the Circuit Breaker that has a special advantage

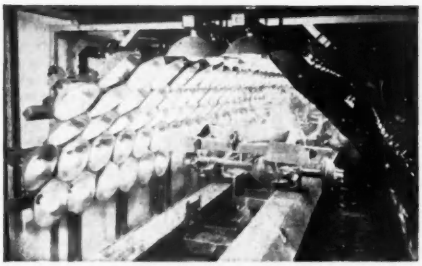
Fully Magnetic!

Where it's HOT

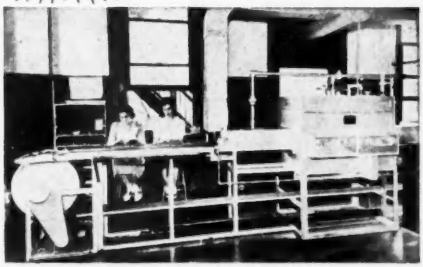
IT CARRIES FULL LOAD REGARDLESS OF TEMPERATURE

Circuit protection is provided entirely by magnetic action. Because Murray Circuit Breakers are fully magnetic, they trip only on short-circuits and dangerous overloads. They always carry the full load, regardless of temperature. They never need "derating."

Where it's HOT



An Infra-Red Baking Tunnel



An Electric Brazing Furnace

Murray Circuit Breakers are ideal under *all* conditions and especially *where it's hot*. In every plant and power company there are places where a Murray Magnetic Circuit Breaker is a *must*: boiler rooms, furnace rooms and near Infra-Red Banks, Induction Heating Coils, Annealing Furnaces, Soldering Pots, Baking Ovens and Tunnels, Radiant Heaters, Convection Heaters, Drying Chambers, Brazing Furnaces. If you have these, or any similar conditions, make sure your protective equipment will carry full load at all times—Use Murray Fully Magnetic Circuit Breakers.

IF YOU WANT TO INSTALL THE BEST... specify Murray

Murray®

MURRAY MANUFACTURING CORPORATION
1250 ATLANTIC AVENUE • BROOKLYN 16, NEW YORK

Service Entrance & Meter Equipment • Magnetic Circuit Breakers • Switches
Current Limiting Reactors • Crows'nest Aerial Ladders

ALL 4 AGREE on NEW APPLETON V-51 SERIES

CONVERTIBLE VAPORTIGHT LIGHTING FIXTURES

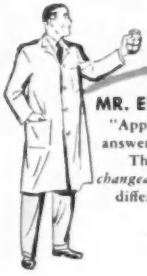
WITH MALLEABLE IRON BODIES

100 WATT OR 150-200 WATT UNITS

MR. PLANT ELECTRICIAN Says: "This V-51 Fixture is a real work-saver! Re-lamping's a cinch. One trip up the ladder to exchange Unit Assemblies and the job's done! Cleans fast, too. I attach or remove reflectors with a twist of the wrist—thanks to V-51's neoprene rubber ring attachment."

MR. PLANT OWNER Says: "Nothing beats this fixture for economical service and maintenance! My men can service it safely and quickly—*without tools!* Converts just as easily to high or low wattages. We're saving lamps, too. V-51's shock-absorbing socket lets us use standard lamps instead of more expensive mill-type bulbs."

MR. ELECTRICAL CONTRACTOR Says: "These V-51 fixtures are tops when it comes to quick and easy wiring. The line's complete, too—gives me a pendant, ceiling or bracket type mounting for every kind of installation. Best of all, these fixtures are efficient and dependable. I know my customers are going to be satisfied with them."



MR. ELECTRICAL WHOLESALER Says: "Appleton V-51 Series Vaportight Fixtures answer my stock-keeping problems perfectly. The line's variety—*plus complete interchangeability of parts*—means I can meet 256 different fixture requirements with only a small investment in inventory!"

Write for Bulletin 5-A

Sold Through Electrical Wholesalers

APPLETON ELECTRIC COMPANY

1704 Wellington Avenue • Chicago 13, Illinois

Branch Offices: NEW YORK, 50 Church St. • DETROIT, 3049 E. Grand Blvd. • CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Minna St. • ST. LOUIS, 227 Frisco Bldg. • LOS ANGELES, 100 N. Santa Fe Ave. • ATLANTA, 724 Boulevard, N. E. • BIRMINGHAM, 429 Brown-Marx Bldg. MINNEAPOLIS, 305 Fifth St., S. • PITTSBURGH, 414 Bessemer Bldg. • BALTIMORE, 100 E. Pleasant St. BOSTON, 10 High Street • DENVER, 1921 Blake Street • PHILADELPHIA, 1017 Cherry Street CINCINNATI, 626 Broadway • HOUSTON, 709 M. & M. Bldg. • HAVANA, Cuba, Malecon No. 9.

Resident Representatives: Binghamton, Dallas, Indianapolis, Kansas City, Orlando, Milwaukee, New Orleans, Seattle, Portland, Ore.

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MALLEABLE IRON CONDUIT FITTINGS

APPLETON

OUTLET BOXES AND SWITCH BOXES

ELECTRIC

INDUSTRIAL LIGHTING EQUIPMENT

PRODUCTS

EXPLOSION-PROOF FITTINGS • REFLECTORS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

With which is consolidated Electrical Contracting, The Electrical and Electrical Record . . . Established 1901

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

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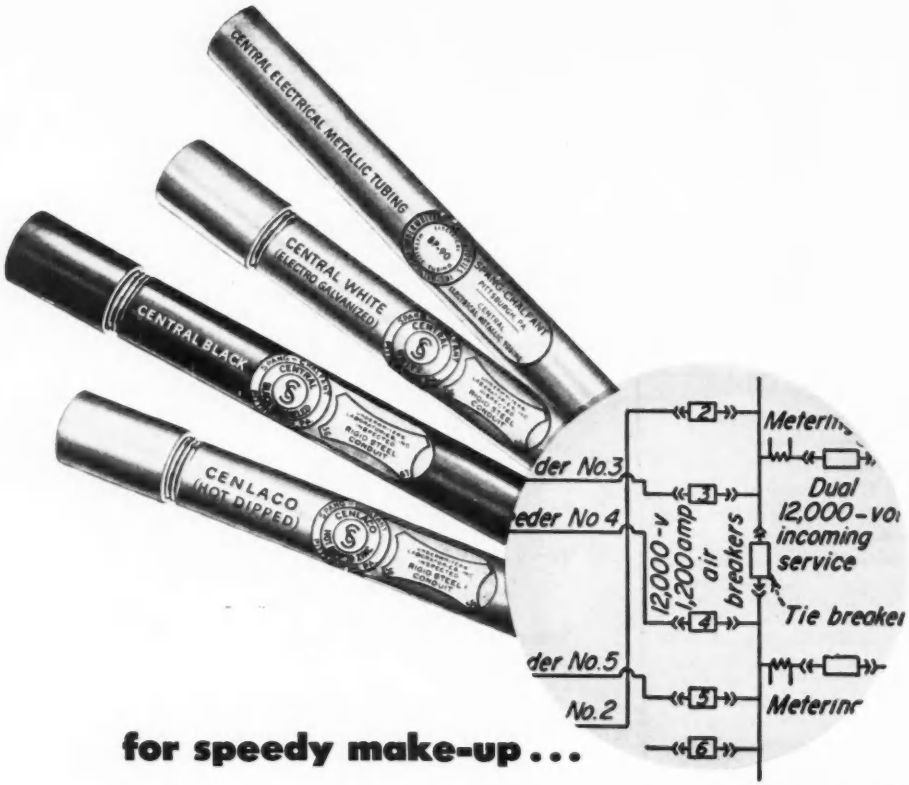


for speedy make-up . . .

choose your conduit from Central's Big 4

Wiring jobs go together fast when the conduit is Central. Uniform quality from bundle to bundle assures uniform, predictable cutting, bending, and fitting-up.

For any wiring job, choose the most suitable, most economical conduit from Central's big 4 . . . "Cenlaco" with hot-dipped galvanized finish inside and out, "Central White" with electrogalvanized zinc outside and black enamel inside, "Central Black" with durable black enamel inside and out, or "Central EMT", a sturdy, lightweight steel conduit that's electrogalvanized outside, black enameled inside.

All Central Conduit is approved by Underwriters' Laboratories and the National Electrical Code. It is easy to cut, bend, and run, easy to fish through . . . and is the result of Spang's 111 years of tubular manufacturing experience.

Your supply house may have difficulty meeting the huge demand for Central Conduit . . . but they are earnestly trying to fill orders fairly, and as quickly as possible.

CENTRAL SPANG CONDUIT

SPANG-CHALFANT
Division of The National Supply Company
GENERAL SALES OFFICE: Grant Bldg., Pittsburgh, Pa.
District Offices and Sales Representatives in Principal Cities

Stadium Lighting Installation—Pole base mechanism permits 3-ganged cutouts to be switched from ground.

Combine fuse protection with "disconnect-under-load"

Low-cost G-E oil fuse cutouts give you both

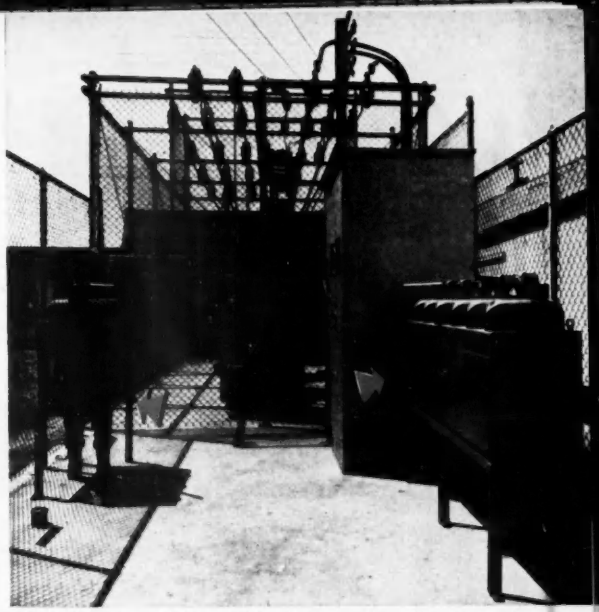
In the G-E oil fuse cutout all arcing occurs under oil when the fuse blows or when switched. The housing, with its drawn steel tank threaded into cast-iron cover, is liberally designed for safety: withstanding internal pressures well in excess of those that can occur at the cutout's interrupting rating. There are no exposed live parts—whether the cutout is in open or closed position—and no expulsion of arc flame.

Special arcing surfaces on the heavy self-aligning contacts keep load-carrying surfaces clean—make it possible to use these cutouts repeatedly as switches to open circuits under loads.

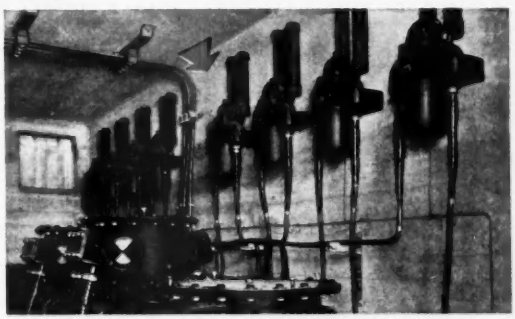
Suitable for both utility and industrial applications, these cutouts are—

1. **Available for 2400-, 4160-, and 7200-volt circuits, current ratings up to 300 amperes; interrupting ratings up to 11,000 amperes.**
2. **Ideal for indoor mounting, vault or subway mounting and outdoor pole or wall mounting.**
3. **Available in metal enclosed assemblies, single or three-phase, rack or wall mounted, and providing for cable, conduit, or pothead connections.**
4. **Provided with switching mechanisms for single- or three-phase switching and pole base operation on rack-mounted or metal-enclosed units.**

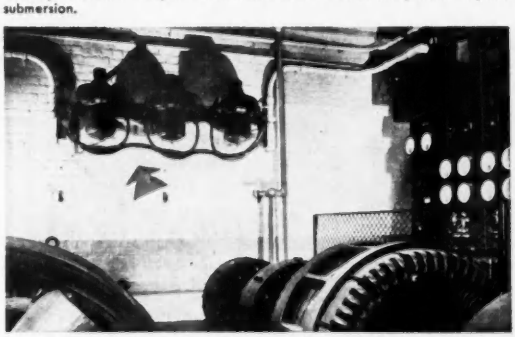
Full information can be found in Bulletin GEA-732—available through your G-E Apparatus Office, or by writing, *General Electric Company, Schenectady 5, New York.*



Outdoor Substation Installation—Metal enclosed assembly avoids exposure of cable entrances and gang-operated mechanism provides for simultaneous switching.



Subway Installation—Expansion chambers attached to cutouts permit complete submersion.



Indoor Substation Installation—Oil cutouts in incoming lines provide high current fusing.

406-40

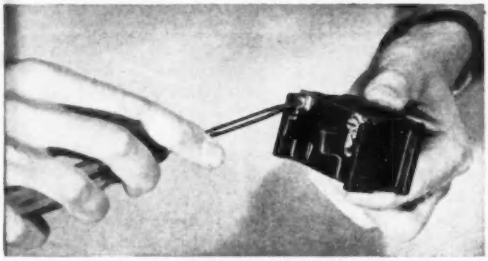
GENERAL ELECTRIC

MOTOR STARTERS ...need less

MARTIN KELLY, PLANT-

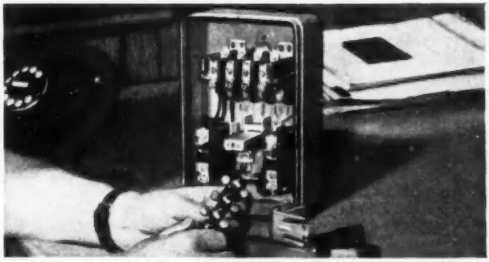
Mr. Kelly: *"A big part of my job is to keep every piece of electrical equipment in the plant going—with the minimum of maintenance. That's why I want to know how a motor starter is going to perform a year, even 5 or 10 years from now. I've found that G-E starters need less upkeep than any other starter on the market today. Let me take it apart and show you why."*

Martin Kelly, Plant Electrician for John R. Evans & Co., changes an overload relay on G-E combination starter quickly and easily.



Mr. Kelly: *"First, the coil. It sure takes rough handling!"*

1 Right you are, Mr. Kelly. We call it the "Strongbox Magnet Coil." That block of plastic keeps the windings permanently protected against dirt, moisture, and oil. And if your screwdriver slips, it can't damage the windings.



Mr. Kelly: *"I've seen no sign at all that these contacts are burning or pitting."*

2 That's because they have fine silver tips that outlast by far the ordinary type contact. Even where it's a "start-stop" job with dozens of operations each minute, they'll stand the gaff.

GENERAL ELECTRIC

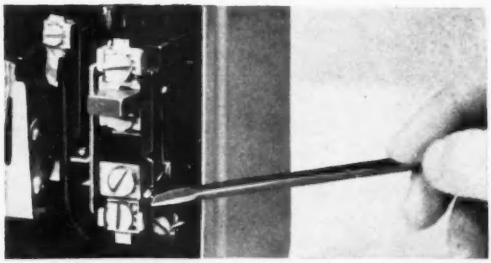
730-20

upkeep for 4 big reasons!

ELECTRICIAN, SHOWS WHY—WITH THE "SCREWDRIVER TEST"

Mr. Kelly: *"There doesn't seem to be any wear on the moving parts."*

3 That's right. The moving structure is rugged and basically simple. There's no metal-to-metal friction between magnet and coil; thus, little or no wear. And the "molded-in" lubricant in the coil keeps the magnet operating smoothly and quietly for life.

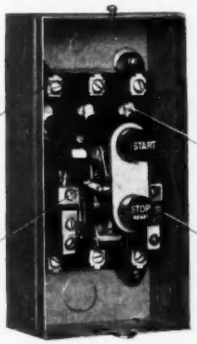


Mr. Kelly: *"Overload protection means a lot; I certainly don't want any burned-out motors these days."*

4 Those overload relays will give your motors all the protection they'll ever need. They are reliable and never need any attention. Heaters are in front and can easily be changed without disturbing any wiring.

MANUAL STARTERS, TOO . . .

For infrequent starting of 7½ hp or smaller motors, you can't beat a G-E manual starter for economy and dependable operation. . . Built to the same rugged specifications as the magnetic starter, it includes many of the same features for long life and easy upkeep.



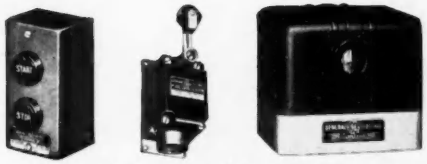
Front-connected clamp-type terminals, and plenty of wiring space.

Fine silver contacts long outlast ordinary contacts

Sturdy, vibration-resistant, snap-action switch mechanism

Bimetallic overload protection with heaters readily accessible

A complete line of control accessories . . .



Push-button stations, limit switches, photo electric relays

. . . and many others can make operations more automatic, more convenient.

BUY ONE AND COMPARE! Disassemble a G-E motor starter, magnetic or manual, and inspect it. See for yourself why G-E starters last longer, cost less to install, and are easier to maintain than any starters you can buy. Your G-E representative or authorized distributor can supply many models of G-E starters in NEMA sizes 0, 1, 2, and 3 for motors up to 50 hp; anticipate your requirements and place your order early. For more information on magnetic starters, write for Bulletin GEA-5153; manual starters, Bulletin GEA-1522. *Section 730-20, Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

DEPENDABLE *Protection*

with

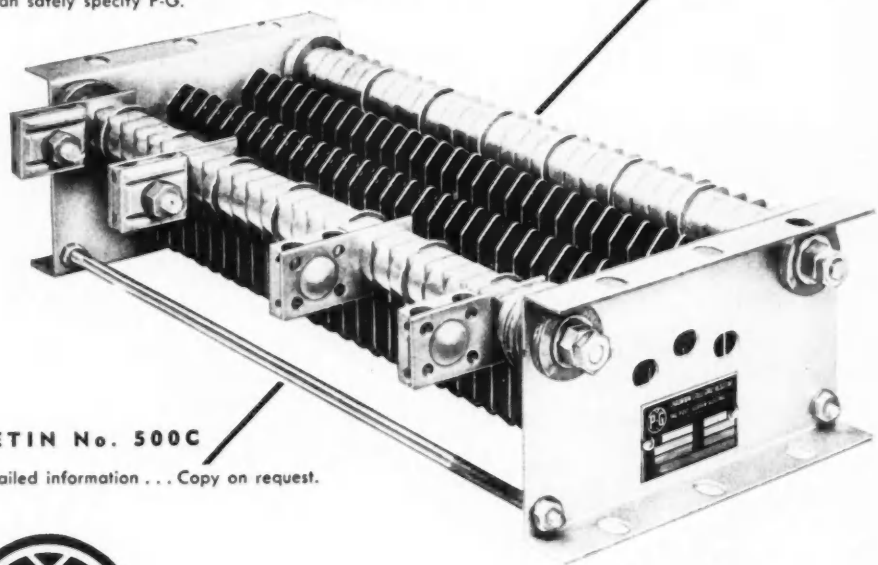
P-G *Steel Grid Resistors*

Steel and Mica, with P-G design, create a resistor really able to protect electrical equipment, especially, where service requirements are severe.

P-G Steel Grid Resistors are sturdy, light in weight, and consistently dependable.

These resistors maintain unusually constant resistance values regardless of temperature or age.

Where "trouble-free" resistor service is essential . . . you can safely specify P-G.



BULLETIN No. 500C

Gives detailed information . . . Copy on request.

P-G

The Nonfreakable Steel Grid Resistor

THE POST-GLOVER ELECTRIC COMPANY

• ESTABLISHED 1892 •

221 WEST THIRD STREET, CINCINNATI 2, OHIO

It's Efficient . . . Economical . . . More Compact . . .

the Completely Re-Designed

FA POWER PLUGIN BUSDUCT

THEY'RE TOPS for industrial power and light distribution . . modern in design, more compact, yet flexible, safe, dependable, efficient and economical . . almost 100 per cent salvageable.

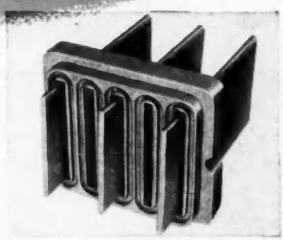
Many of the features which made Plugin FA Busduct so popular with industry, have been incorporated in the re-designed FA Power Plugin . . . and several new ones have been added.

The housing, for instance, has been made smaller — only 7″ wide — enabling it to be used in restricted space. Insulators are new one-piece glazed porcelain with steel channel supports riveted into position.

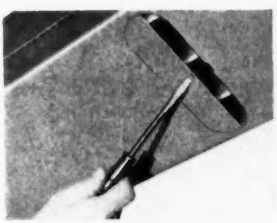
Sliding type plugin opening covers, new simplified, adjustable, two-screw type fasteners for plugin units, two sliding type mounting brackets per section for hanging as desired, silver-plated contact surfaces with two or four brass jam bolts with phosphor bronze cup washers in elongated fastening holes, and attractive pearl grey housing finish, are other features.

Add to these the advantages of plugin outlets every foot of the way . . . providing a ready power source for new or present equipment all along the line, thus eliminating long temporary leads, production delays and high maintenance costs . . . and you'll agree that FA Power Plugin Busduct is the answer to today's mighty production demands.

Want to know more about this modern system of power distribution? Contact your nearest FA Representative (listed in Sweet's) or write to our factory.



New one-piece glazed porcelain insulator. (Steel channel support not shown).



Sliding type, easily operated plug-in opening cover permits plugin unit to fit tightly against housing.

Capacities: 250 to 1000 amps, 600 volts AC or less with Klampswitchfuz, Shutlbrak or Circuit Breaker plugin units for 200 amps or less

FA TRADE MARK

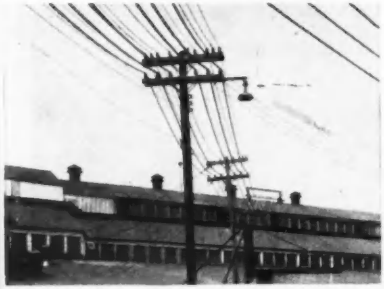
Frank Adam Electric Co.

P. O. BOX 357 ST. LOUIS 3, MO.

Makers of BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER

Our 60th Year

MODERN G-E LOAD CENTER UNIT installed at the Traylor Engineering and Manufacturing Co., Allentown, Pa. This unit consists of a dry type transformer and switchgear, completely enclosed in steel. Power is received at 2400 volts and stepped down to utilization values. Note placing of unit in waste space under stairway.



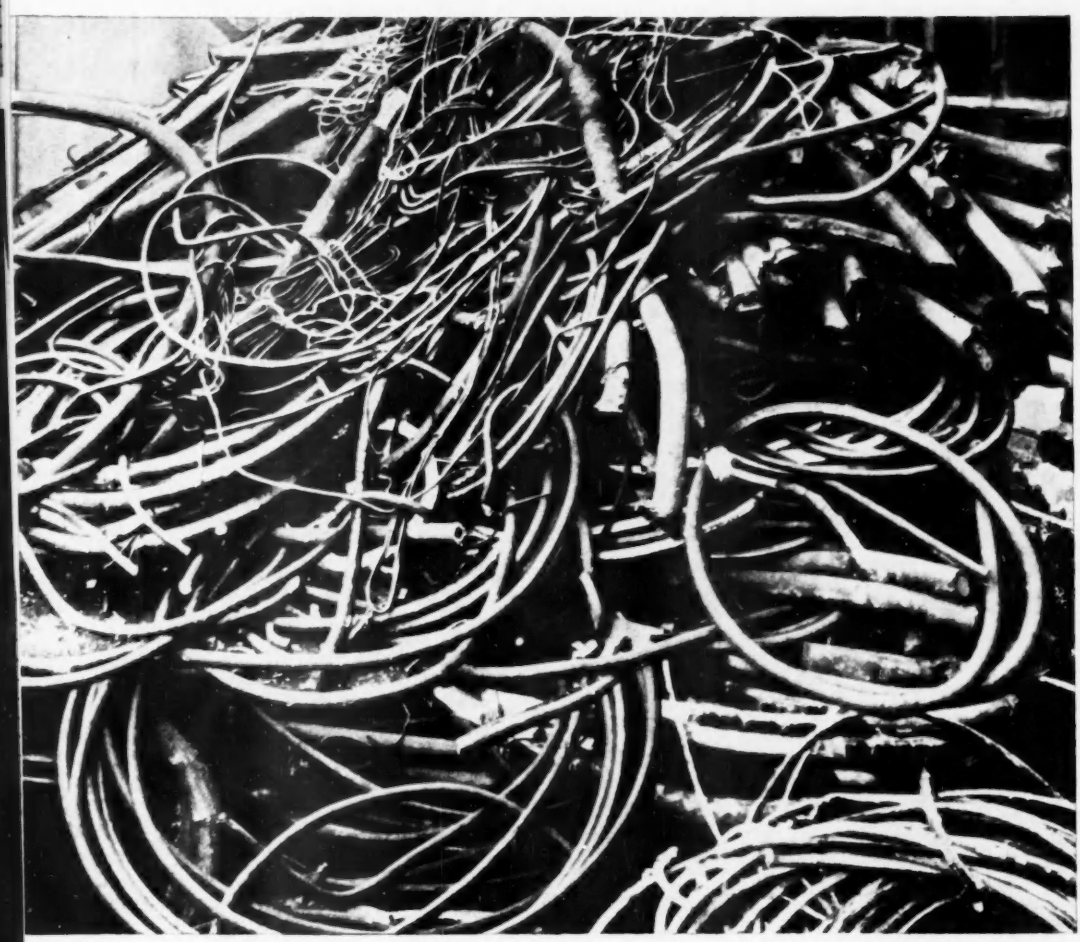
BEFORE—AND AFTER! Here are photos of poles that carried the old 240-volt distribution lines, before and after the cables had been removed. The many low voltage cables have now been replaced by a 3-phase cable installed underground.

LOAD CENTER SYSTEM

Replacing an octopus of long, heavy 240-volt distribution lines, three small high voltage cables now carry all the power required for expanded, more efficient production at the Traylor Engineering and Manufacturing Co., Allentown, Pa.

If the old system had been continued, more than 10% additional copper would have been required to provide for expansion. This is more than the amount necessary for the new high-voltage cable, which will carry all the power required for years to come.

Today, power is distributed at 2400 volts to various G.E. Load-center unit substations like the one above, where it is stepped down to utilization values. Because load-center units are located close to the machines they serve, secondary feeders are kept short, saving expensive



SAVES TONS OF COPPER

low-voltage copper. Although the new high-voltage lines are more than 90% smaller in size than the old low-voltage distribution cables, they carry considerably more power.

After the new load-center system had been installed, the pile of copper cable shown above was all that remained of the old outdoor, pole-mounted, 240-volt distribution system at the Traylor Engineering & Manufacturing Co. Over and above the salvage of vital copper in this cable, the Traylor Company actually saved copper in putting in its new high-voltage distribution system.

For complete information on this modern power supply system for your plant, write for Bulletins GEA-3592 Load Center Unit Substations and GEA-3758 Load Center Power Distribution. *General Electric Company, Schenectady 5, New York.*

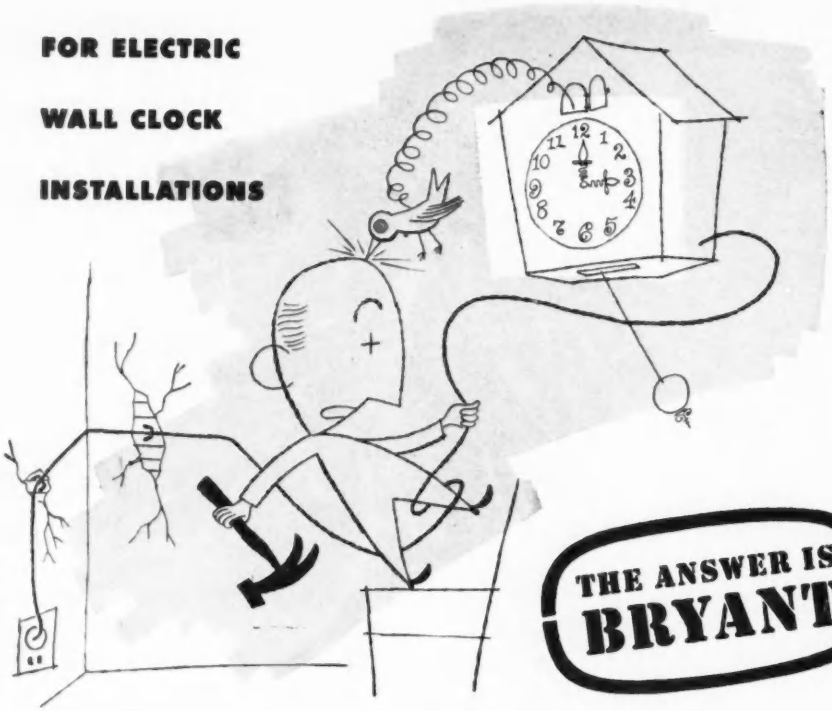
GENERAL ELECTRIC

321-75

FOR ELECTRIC

WALL CLOCK

INSTALLATIONS



THE ANSWER IS BRYANT

No. 2992

No. 2828

CLOCK HANGER OUTLETS 15 Amperes 125 Volts
10 Amperes 250 Volts

Bryant clock hanger Outlets do away with unsightly, dangling cords in electric wall clock installations. All excess cord nests in the recess. These outlets provide support for the clock as well as a concealed electrical connection. The clock completely covers the outlet, giving a neat appearance. Ideal for residential or commercial installations.

NO. 2992 One piece bakelite construction with parallel slots. Available in brown or ivory.

NO. 2828 "T" slots, removable .060" brass plate. Approved for Federal Specifications.

Listed as Standard by Underwriters' Laboratories, Inc.

BRYANT
SUPERIOR WIRING DEVICES

THE BRYANT ELECTRIC COMPANY

Bridgeport 2, Connecticut

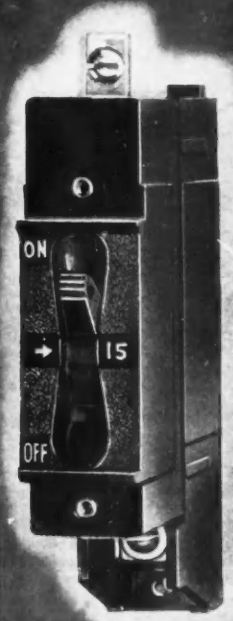
CHICAGO • LOS ANGELES

SPECIFY BRYANT DEVICES FROM YOUR ELECTRICAL WHOLESALER J-99850

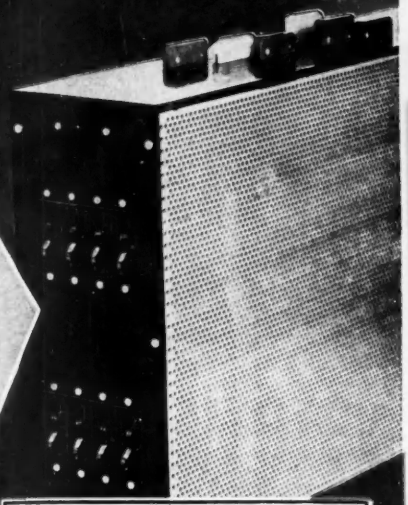
HEINEMANN

MAGNETIC CIRCUIT BREAKERS

Stand Guard Over ALL EIGHT CIRCUITS
of This Davis Portable Switchboard Dimmer



ONE 15 AMP. BREAKER
SIX 20 AMP. BREAKERS
ONE 50 AMP. BREAKER



One end of the unit houses six 20-ampere silent magnetic breaker switches which protect each output circuit. One silent master 50-ampere magnetic breaker switch protects the master coil and eliminates danger of overload. A 15-ampere magnetic switch protects hot line for auxiliary circuits which cannot be dimmed; this circuit also controls the pilot light on top of the case.

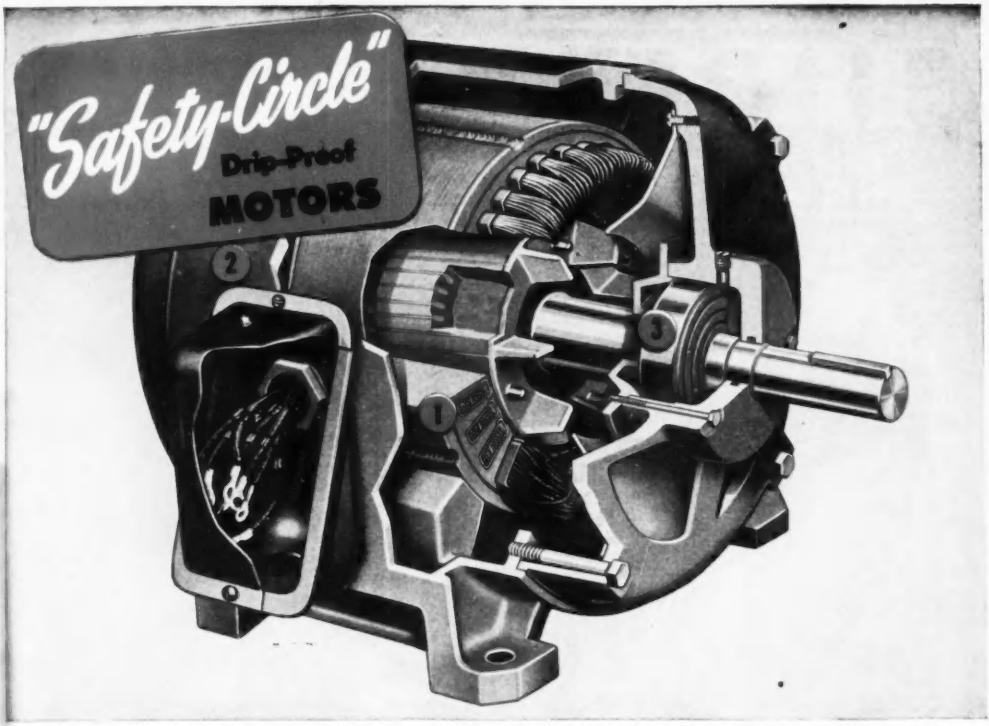
INSTANT PROTECTION—
TIME DELAY ON MINOR OVERLOAD—
CARRIES FULL RATED CAPACITY

Here is an installation that gives an important plus in circuit protection afforded by HEINEMANN CIRCUIT BREAKERS. Each circuit for this Davis Dimmer is protected by a breaker with rating exactly suited to the requirements. these breakers are DIFFERENTIAL MAGNETIC (no thermal units) they trip instantly on short circuit or dangerous overload— not even a fraction of a second needed for any element to heat. But a magnetic-hydraulic TIME DELAY permits the passage of starting surge or minor overload for a very limited time without tripping the breaker.

Write For Bulletin 3100

HEINEMANN ELECTRIC COMPANY

99 PLUM STREET EST. 1888 TRENTON 2, N. J.



Safety-Circle Motors Give You Extra Protection 3 Vital Ways

1 Protection Against Electrical Breakdown — Stator punchings of low-loss electrical steel are welded together to form a rigid base for the windings. Complete stator is multiple dipped in special insulating varnish and baked after each dip. Special cambric insulation is placed in coil ends between phases to provide further protection against electrical breakdown.

2 Protection Against Physical Damage — Cast iron frame completely enclosing working parts on all sides rigidly maintains alignment and protects motor against blows, falling objects and other physical damage. Cast iron inherently resists corrosion better than other metals used for similar purposes.

3 Protection Against High Maintenance Costs — Bearings are pre-lubricated at the factory and should need no attention for long periods. Tapped holes with pipe plugs to permit regreasing and to provide grease relief are provided.

NOW, when costs are high and skilled labor is becoming scarce, you need these extra protection features that only *Safety-Circle* Motors give. 94 Allis-Chalmers Certified Service shops throughout the country give you economical, factory approved service and genuine parts.

Call your Allis-Chalmers Authorized Dealer or Sales Office for your motor needs, or write Allis-Chalmers, Milwaukee 1, Wisconsin for Bulletin **51B6210.**

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

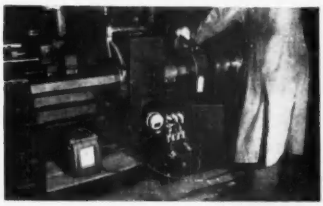
PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

Safety-Circle, Texrope and Vari-Pitch are Allis-Chalmers trademarks.

ALLIS-CHALMERS

A-3340

TESTING TIPS



Load Studies Made Easier With CF Inkless Recorder

In order to plan distribution of power in your factory it is necessary to make accurate long-period circuit voltage surveys. This can only be done efficiently through the use of recorders. The G-E Type CF-1 inkless recorder is ideal for this operation. It is designed for dependability and maximum convenience. With the CF-1, one skilled electrician or engineer can supervise the power requirements for an entire plant. Records of various machines in operation can be gathered into one place for one man to analyze.

Today it is vital that survey records show load pictures on various critical machines throughout the plant. The CF-1 will tell you whether increased schedules are overloading machines and shortening the life of your equipment. You save by avoiding costly down time and overhauls.

Available in a variety of voltage ranges the CF inkless recorder has an accuracy of 1½ percent of full scale-value—its record roll can run as long as 30 days without attention.

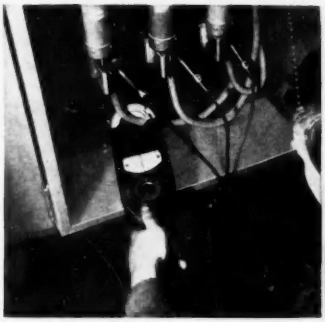
FEEDER CAPACITY SURVEYS DIFFICULT

New AK-3 Hook-on Instrument Reads Power Factor Directly

To get a true picture of power-factor conditions in your plant, p-f measurements must be made frequently and at different points in the circuits. Your present method of measuring p-f requires: power shut-off, cutting of lines, and connection of instruments into both current and potential circuits. These time consuming tasks make the new G-E Type AK-3 hook-on power factor meter an essential instrument for your maintenance kit. Power-factor readings are obtained by merely hooking around the line, clipping in the voltage leads, and reading p-f directly on the dial.

Power factor is more important than ever today when we are trying to obtain the maximum capacity from factory circuits. Capacitors are one of the quickest and least-expensive ways of increasing feeder capacity. They can permanently release up to 30% more electrical capacity in your power system. This means extra capacity available for new lighting and motor loads—with no additional transformers or distribution equipment needed. The table at right will show you what you can expect from capacitor additions to your feeder lines.

The AK-3 may be used on any balanced 3-phase circuit. It reads power factor directly in circuits with voltages from 100-600 volts, and currents from



15 to 600 amperes. It is accurate to within 0.05 p.f.

if your power factor is now	you can release this much extra capacity	with this many capacitors for each 100 kw of load
65%	34%	84 kvar
70%	29%	69 kvar
75%	23%	55 kvar
80%	17%	42 kvar
85%	11%	29 kvar
90%	5%	15 kvar

(Power factor is raised to 95%. New load is at original power factor.)

PLANT SUPERINTENDENT REPORTS . . . "With my new AK-2 hook-on wattmeter I can do this job in a quarter of the time it formerly took me with conventional instruments."

Mr. W. D. Bostwick, pictured at left, is the plant superintendent for Bramley Storage Co., Cleveland, Ohio. Bramley has a power block in Cleveland which contains 15 companies, all manufacturing widely different products. With more of these companies turning to defense production, load conditions are increasing. "We have an extensive distribution system in our plant and this AK-2 has made it possible for us to make a complete load and power factor survey quickly and accurately," says Mr. Bostwick.

With the AK-2 hook-on wattmeter, this testing job has been made easier. There is no interruption of service, you just clip the two potential leads across the line, hook the AK-2 around one conductor and take your reading in watts. The AK-2 measures single-phase and polyphase circuits with an accuracy of 5% of full-scale value. Extremely light—it weighs only 4 pounds.

GENERAL ELECTRIC

602-201

SECTION A 602-201, GENERAL ELECTRIC
SCHENECTADY 5, N. Y.

Please send me the following bulletins:

Indicate:
√ for reference only
× for planning in immediate project

☐ Type AK-3 Hook-on Power-factor Meter GEC-775
☐ Type AK-2 Hook-on Wattmeter GEC-591
☐ Type CF Inkless Recorder GEC-215

NAME .....
COMPANY .....
STREET .....
CITY ..... ZONE ..... STATE .....

CURTIS

LIGHT SOUND CONDITIONING

SYSTEM

PAT. APPLIED FOR

CURTIS
LIGHTING, INC.

6135 WEST 65TH STREET, CHICAGO 38, ILLINOIS

NEW...

This exclusive Curtis-designed 8" x 12" x 156" package houses one section of a completely wired lighting assembly which covers a ceiling area of 160 sq. ft.

The revolutionary CURTIS LIGHT AND SOUND CONDITIONING SYSTEM offers an entirely new concept of lighting. This Curtis System provides recommended levels of quality illumination with acoustical treatment which eliminates excessive sound reflections and the annoyance and distractions which sound creates.

Write for information about the Curtis Light and Sound Conditioning System's unlimited applications.

SALES OFFICES: ATLANTA • BALTIMORE • BOSTON • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT • INDIANAPOLIS • KANSAS CITY • MIAMI
MILWAUKEE • MINNEAPOLIS • NEW ORLEANS • NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • SAN FRANCISCO • SEATTLE • ST. LOUIS • TORONTO

ORANGEBURG IS EASY TO WORK...

Easy to Tool and Assemble Contractors Find Orangeburg Jobs Profitable

Like a willing horse, Orangeburg Conduit helps make jobs easier and more profitable for Contractors. That's because its light weight and long lengths make for easy handling and ready work-ability. Orangeburg always lays faster and at lower cost than any other type of conduit.

THE USER GETS A BETTER JOB... YEARS ADDED TO CABLE LIFE

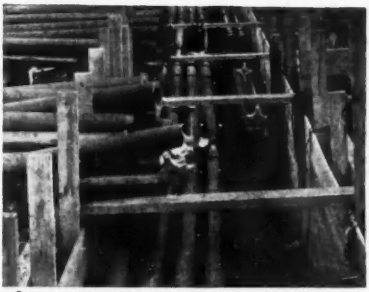
. . . because Orangeburg's low coefficient of friction keeps pulling tensions on cable to minimum . . . because its smooth bore protects cables from abrasion . . . because it combines toughness and flexibility in ideal proportions to withstand traffic shocks, soil settlements or temperature changes . . . because its permeable wall and tight joints prevent infiltration of corrosive ground waters . . . because it resists acids, alkalis, grease, oil, salt.

The *orange-colored* trademark identifies *all* Orangeburg Conduit for your protection. SEND FOR FREE Illustrated Folder. Write to Dept. EC-6, Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y.

ORANGEBURG *Fibre* CONDUIT

STANDARD *installed with Concrete* · **NOCRETE** *installed without Concrete*

NOCRETE for one or two ducts . . . installed *without* concrete encasement.



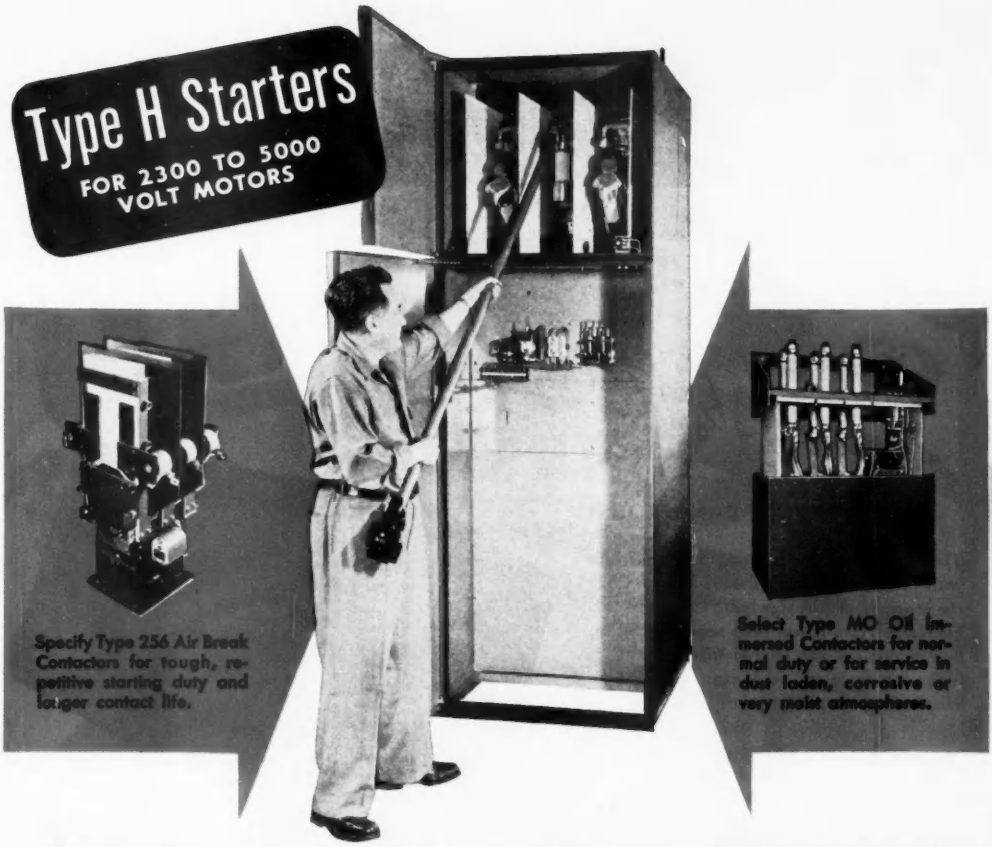
STANDARD for three or more ducts . . . installed *with* concrete encasement.

Graybar ELECTRIC COMPANY

DISTRIBUTORS, ORANGEBURG FIBRE CONDUIT

GENERAL ELECTRIC SUPPLY CORPORATION

Branches and Stocks in Principal Cities


Type H Starters
FOR 2300 TO 5000 VOLT MOTORS
Specify Type 256 Air Break Contactors for tough, repetitive starting duty and longer contact life.
Select Type MO Oil Immersed Contactors for normal duty or for service in dust laden, corrosive or very moist atmospheres.

Engineered to Your Needs!

EVERYTHING you need for complete control and protection of your motors is engineered as a single unit when you specify Allis-Chalmers Type H Starters.

Air break or oil immersed contactors . . . whichever is best suited to your application . . . may be built into your Allis-Chalmers Type H Starter. Meters, overload relays, current limiting fuses, auxiliary switches — all needed parts are selected to meet the requirements of your application . . . then assembled into an attractive, easy to install steel cabinet. Type H Starters are compact to save floor space, compartmented to simplify maintenance and protect personnel.

There is a Type H Starter to fit your needs. For full or reduced voltage starting, for reversing or dynamic braking . . . to control squirrel-cage, wound rotor or synchronous motors . . . Allis-Chalmers Type H Starters will be your right answer.

Remember, they are engineered for dependability, designed for ready access and built to give long life with low maintenance. Call your nearby A-C representative, or write Allis-Chalmers, Milwaukee 1, Wis. for bulletin 14B6410A.

A-3353

MAXIMUM HORSEPOWER

Type of Contactor	2000-2500 Volts			4000-5000 Volts		
	Synchronous		Induction	Synchronous		Induction
	1.0 PF	.8 PF		1.0 PF	.8 PF	
Air	1500	1250	1250	2500	2250	2250
Oil	800	700	700	800	700	700

ALLIS-CHALMERS

THEY MAY LOOK ALIKE... BUT NEVER ACT THE SAME!

Imitation, as the saying goes, is the greatest source of flattery. However, there are times when it can also be the greatest source of trouble. So, remember when buying, screw anchors...

THE INSEPARABLES

*Substitutes

CAN PROVE DANGEROUS!

The word "Rawlplug" used in connection with *Jute Fibre Screw Anchors* is exclusively the property of The Rawlplug Company, Inc. For forty years it has been secured to them by common law and by trademark registry. It is the corporate and trade name of the company and specific product of their manufacture.

BE SECURE BY BEING SURE

Look for the Trade Name **RAWLPLUGS** *on the* Blue Box

THE RAWLPLUG LINE

RAWL-DRIVES
Bolt and Anchor in one piece—drives like a nail into a drilled hole and holds like a bolt. Used only in hard materials, such as concrete, brick, etc.

RAWL-TAPERS
For machine screws. A Machine Screw Anchor that fits the hole drilled, either by a new or worn drill.

RAWL HAMMER-SETS
Heavy duty threaded type machine bolt anchor, ideal for bottomless holes, hard floor topping.

RAWL-ANCHORS
For holding bolts permanently in materials such as concrete, marble, stone, brick, etc. Heavy duty type.

RAWLDRILLS
The original 3-point drill for drilling holes in all masonry. Quickly and easily sharpened. For hand and power drilling. Also Rawl Carbide Tipped Drills for use in electric drills sizes $\frac{3}{16}$" to $1\frac{1}{2}$".

When you use Rawlplugs you are using the original and genuine... the only screw anchor with the features that make them worthy of imitation... RAWLPLUG!

Rawlplugs because of their chemically treated braided jute fibre construction... Hold Better ... Last Longer ... Weigh Less and Hold More! They eliminate extra troublesome spotting and layout work. Rawlplugs are the only universal anchors which can be used in any material.

"IF YOU DON'T USE RAWLPLUGS... THERE'S A SCREW LOOSE SOMEWHERE"

For Information write Dept. E

12-L-11

The Rawlplug Company, Inc.
271 Church Street, New York 13, New York

THERE ARE RAWL
... EXPANSION BOLTS, SCREW ANCHORS AND MASONRY DRILLS FOR EVERY NEED.
SOLD THROUGH ALL LEADING HARDWARE, ELECTRICAL AND MILL SUPPLY HOUSES

A COMPLETE LINE OF SWITCHBOXES
A COMPLETE LINE OF OUTLET BOXES AND COVERS
CONDUIT FITTINGS FOR EVERY REQUIREMENT
FLOOR & JUNCTION BOXES, INSULATOR SUPPORTS, FISHWIRE, BENDERS
It may be true that
Too many cooks spoil the broth
but it is just as true that
A cook can have too many broths on the fire
The latter reasoning has been used by Steel City for almost fifty years.
Steel City SPECIALIZES in electrical boxes, covers and conduit fittings and each item is carefully designed for the purpose for which it is intended and reduce installation time.
that is why - in these lines . . .
STEEL CITY LEADS IN MEETING CONTRACTORS' NEEDS
STEEL CITY ELECTRIC COMPANY
1207 COLUMBUS AVENUE, PITTSBURGH (33), PENNA.

as fundamental as built-in plumbing...

Leo L. Fischer, *Architect*

No electrical contract is complete unless it contains a provision for telephone raceways.

Concealed telephone wiring is as important to interior appearance as concealed water pipes. Yet without telephone raceways, there's always the chance that the wires will be exposed. You'll find it a profitable practice to include telephone raceways in your contracts with home builders. It's an "extra" that means more money for you, more convenience and beauty for the owner.

BELL TELEPHONE SYSTEM

There's STRENGTH *in* UNION!

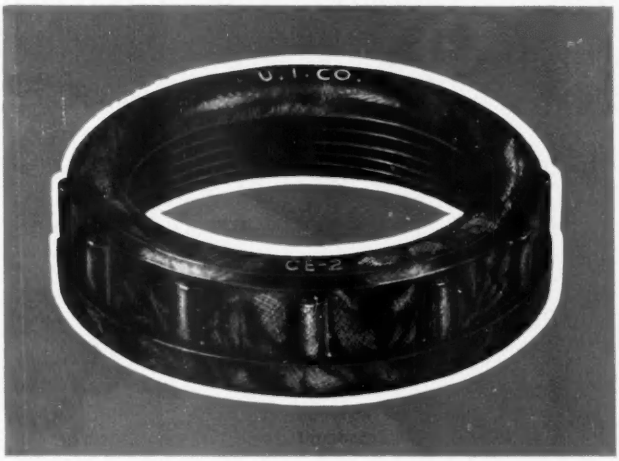
Where Strength Counts

be sure

YOU SEE THE CANVAS

when you buy INSULATED BUSHINGS

SIZES 1¼" – 6"



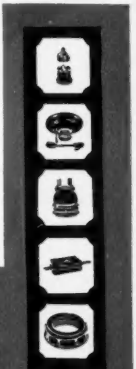
Experience proves that conduit wiring jobs using conductors of No. 4 or larger require insulated bushings of maximum strength.

Union's Canvas Impregnated Insulated Bushings are molded in generous proportions of the highest strength Bakelite.

The canvas cloth evident on the surface is your guarantee of maximum strength. Insist on bushings with the "canvas" in full view and insure the most trouble-free, safe wiring jobs.

UNION INSULATED CONDUIT END BUSHINGS

LISTED BY UNDERWRITER'S LABORATORIES INC.



Made tough to stand hard service

UNION INSULATING CO.
PARKERSBURG, WEST VIRGINIA

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

TYPE AVRB
15 to 100 kva

TYPE AJRB
3 to 10 kva

TRIPLE

Protection against Overloads

Trouble caused by short circuits or by transformer overloads is stopped before it starts when you use Westinghouse Dry-Type Transformers with built-in circuit breakers. The breakers are connected in the high-voltage circuit, and are actuated by either (1) the coil-load current, (2) the temperature of the air within the transformer or (3) by both. This triple action provides *complete protection . . . sure* safety for circuits if trouble occurs. Furthermore, the co-ordinated time lag of the breaker permits carrying nondamaging, short-time overloads without service interruption.

You can get quick, economical correction of overloaded circuits with Westinghouse Dry-Type Transformers that have breaker performance like this . . . plus these additional features:

LOW INSTALLATION COST: Connect direct to wiring or raceways. Because you can install dry-type transformers close to the load, long runs of low-voltage lines can be eliminated.

EASY MOUNTING: Mount them wherever power is needed—on the floor, walls, columns, platforms, or overhead.

LOW MAINTENANCE COST: Dry-type construction is recognized as the "minimum maintenance" transformer design.

Save on power costs—run *your* distribution voltage close to the load with Westinghouse Dry-Type Transformers. Available in hv ratings of 600, 480 and 240, 100 kva and below, single phase. Ask your Westinghouse representative for Booklet B-4439, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70555

Westinghouse

DRY-TYPE TRANSFORMERS

A "Quote" about efficient job management

FROM THE REPORT OF THE RESEARCH & EDUCATION COMMITTEE OF THE NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

"Not the least important of the functions of electrical contracting is that of job management which interests itself in the details of each installation and assumes the responsibility of providing a smooth-running production machine. Job management, in supervising the actual installations, directs, guides, and assists every operation involved and furnishes information from which the accounting department can prepare sound cost accounting records."

And it's Efficient Management to Sell Day-Brite Lighting Fixtures for Every Job

Yes, it's your job to study all the details of every installation . . . to be responsible for satisfying both your customer and your profit margins. You come out better three ways when you sell Day-Brite fixtures.

Your customers will appreciate Day-Brite quality, its fine workmanship, its longer-service life, its lower maintenance and operating costs. Once you convince him that Day-Brite's *quality is economical*, you'll have a satisfied customer who will come back to you again.

You'll be pleased by every Day-Brite installation because Day-Brite fixtures are easier and quicker to install . . . your men *save time* on every job . . . and every job requires less of *your* supervision . . . fewer costly "call backs" and extra service, too.

And your accountant will be happy. When you sell Day-Brite, you avoid the cutthroat competition of low-priced, inferior products . . . you miss those profit-squeezing bids. You get a square profit and a protected profit.

Efficient job management? One easy way to give yourself a smoother running, faster working, more profitable organization is to sell Day-Brite quality fixtures—every time. Day-Brite Lighting, Inc., 5402 Bulwer Ave., St. Louis, Mo.

NOW, MORE THAN EVER...

AMERICA MUST *SEE* WHAT IT'S DOING

IT'S EASY TO SEE WHEN IT'S

"DECIDEDLY BETTER"
DAY-BRITE
Lighting Fixtures

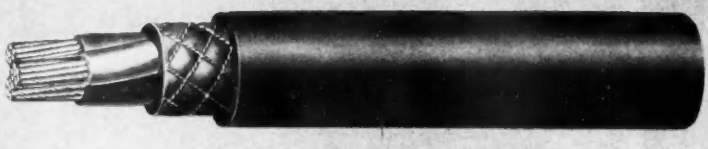
132

• MAXIMUM PROTECTION AND LONG LIFE •

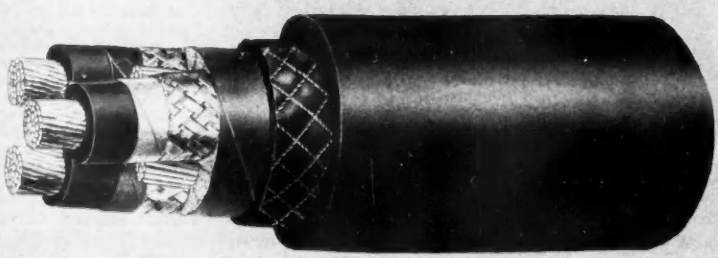
CRESCENT

IMPERIAL NEOPRENE

Portable Cords and Cables



TYPE W-600 VOLT CABLE
For use with heavy duty, portable equipment



TYPE SH-D 5000 VOLT TRAILING CABLE
For supplying power to electric shovels, dredges, etc.

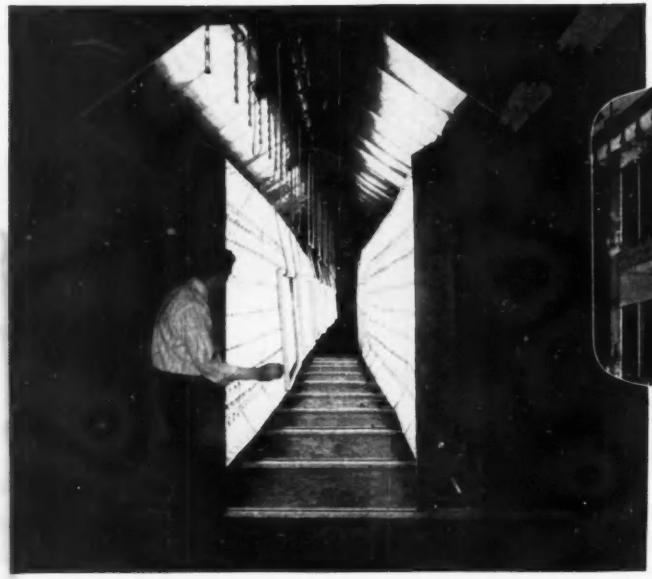
CRESCENT
WIRE and CABLE

OVER 60 YEARS EXPERIENCE

CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, NEW JERSEY

ALLIS-CHALMERS
Dry-Type
Transformers

Step Down Voltage RIGHT AT LOAD



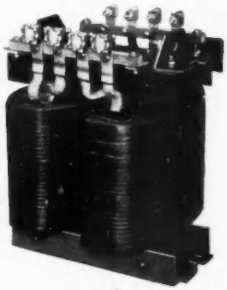
This bank of 37½ kva dry-type transformers is used to supply power to an infra-red lighting installation (shown at left) used for drying painted panels.

The transformer gives new flexibility in matching changing loads. Whenever lighting is altered or machines are relocated, it can be moved quickly because of its lightweight.

IN MEETING TODAY'S EMERGENCIES you may have to convert some of your plant operations almost overnight. This will mean rearranging plant layout, relocating machines, altering lighting and power services. For such conversions you'll find Allis-Chalmers dry-type transformers can be installed in a few minutes, thus preventing costly delays and bringing power close to the load.

"The most practical transformer I ever installed" is the way many an engineer has described the Allis-Chalmers dry-type transformer. These transformers are lightweight, small in size — they're built with heat resisting "Fiberglas" insulation. You can mount them on platforms, posts or on the machine itself. Solderless connectors on all popular sizes reduce hook-up time.

Spotting the transformer close to the load keeps secondary feeders short, helps you get full use of the power you buy. You will welcome savings in hard-to-get copper conductors and reduced power losses. The dry-type transformer helps you put rated voltage right up to the motors and lighting equipment — speeding up motor starting and improving voltage regulation. By operating motors, lights and other equipment at rated voltage you obtain more efficient performance.



Transformers are rated up to 300 kva, 600 volts and below. For more information about dependable Allis-Chalmers dry-type transformers, call your nearby Allis-Chalmers district office or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3361

ALLIS-CHALMERS

Pioneers in Power and Electrical Equipment from Generation through Utilization

With this remote-control wiring system built into the top of a coffee table, Mr. John Aldrich has instant finger-tip control of every fixture in his remodeled showroom. Here, at the Aldrich Electric Company in Patchogue, N. Y., Mr. Aldrich can demonstrate his entire fixture line from one spot. This installation helps sell fixtures, and doubles as a working demonstration of the G-E remote-control wiring system.

Contractor Profits Two Ways with G-E Remote-Control Wiring System

The G-E remote-control wiring installation simplifies roughing in. Mr. Aldrich, who is also an electrical contractor, realized considerable material savings using small-size, light-weight, low-voltage wire for the switch controls.

How many ways can you profit by recommending and installing General Electric remote-control wiring systems? Mr. Aldrich gained by getting a sales-building showroom with flexibility of control impractical with conventional systems.

You may find the same values in G-E remote control. Or your profits may come from getting important contracts that logically call for G-E remote control; or your share of a job may be increased, because you provided an imaginative touch to solve wiring requirements.

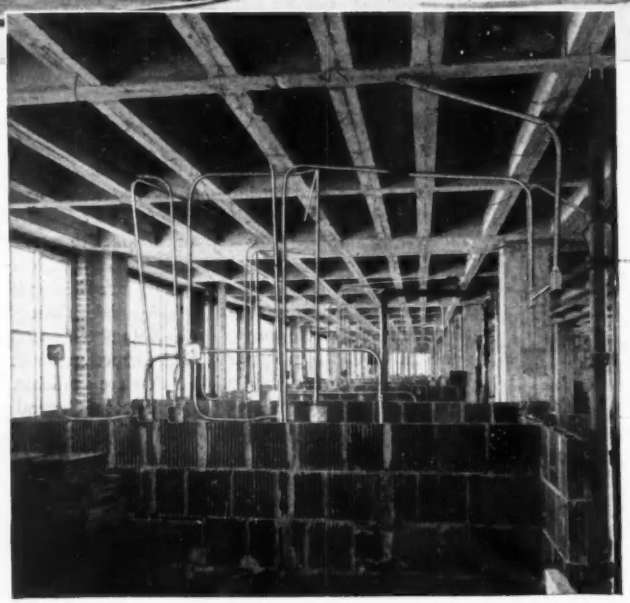
Find out about G-E remote control for multicircuit switch-control systems for industrial and commercial buildings and for homes. Write for a free copy of the G-E Remote-Control Wiring System Manual. Talk to your G-E Construction Materials distributor about consumer sales helps that are available. Section D75-618, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

You can put your confidence in—

GENERAL ELECTRIC

Atlanta's GEORGIA BAPTIST HOSPITAL

Wired *the Modern Way* with



Georgia Baptist Hospital, Atlanta, Georgia,
Architects: Stevens & Wilkinson, Atlanta,
General Contractors: Henry C. Beck Company, Atlanta
Electrical Contractors: Whitehead Electric Company, Atlanta

Over 90,000 feet of Republic ELECTRUNITE E.M.T. *Raceways protect vital electrical conductors throughout this modern hospital.*

ELECTRUNITE E.M.T. Raceways

ALL THE MANY MILES of vital electrical conductors in this modern $4,560,000 hospital are armored against moisture, fire, and mechanical accident by 18 miles of ELECTRUNITE E.M.T. Raceways.

Journeymen will find ELECTRUNITE E.M.T. easy to install. This light-but-strong rigid steel raceway is readily bent to fit right the first time. Handy built-in inch-markings on every length permit accurate fabrication of complicated runs. ELECTRUNITE E.M.T. is light in weight for easy handling . . . Underwriters' approved couplings and box connectors assure a safe and dependable raceway installation.

It's easy to fish and pull wires through ELECTRUNITE E.M.T. . . . thousands of inside knurls provide friction-free bearing surfaces.

Republic ELECTRUNITE E.M.T. meets the requirements of Underwriters' Laboratories, the National Electrical Code, and hundreds of local codes for exposed, concealed, and concrete-slab installations.

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Due to defense priority commitments on steel, he may be temporarily out of the sizes and quantities of ELECTRUNITE E.M.T. that you need. But he is getting his fair share of our output . . . and he'll make every effort to fill your order promptly. Tell him as far ahead as possible what you require.

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LIGHTWEIGHT THREADLESS RIGID STEEL RACEWAY

90% Copper; hard drawn rod with forged spacer.
Machined from hard drawn aluminum.
SERVICE • CONNECTORS
Approved by UNDERWRITERS' LABORATORIES
Service Entrance Connectors; all sizes.
Service Post Connectors to meet any specifications.
Full line of aluminum connectors.

ALL TYPES and SIZES. Yoke-and-Nut Type, No. 10 to 1,000,000. Also Service Entrance, Service Post and Special Connectors (widest variety— more are shown below)

Penn-Union Service Connectors have accurate machine-cut threads, and carefully chamfered edges—do not catch in lineman's gloves.

Durable—re-usable over and over. Fully approved by Underwriters' Laboratories and the highest authorities in the utility field, for the most exacting service.

Penn-Union also makes the *complete* line of Tee Connectors, Cable Taps; Straight, Parallel, Elbow and Cross Connectors; Bus Supports, Clamps, Spacers; Ground Clamps, Terminal Lugs, etc., etc.

Leading users found that "Penn-Union" on a fitting is their best guarantee of Dependability.

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THE *COMPLETE* LINE OF CONDUCTOR FITTINGS

PENN-UNION

We Mobilize for Freedom

WHY Controls are Necessary

One of the encouraging characteristics of the American people is their dislike for government controls. This augurs well for the future of their economic and political freedom.

But for the next few years we must not only tolerate but also help to make effective a whole battery of emergency government controls over our economic life. If we fail to do this now the future of that freedom we cherish will be imperilled. It is the purpose of this editorial—the third in a special series—to explain in simple terms why this is so.

After our military victory in World War II, we rushed through a demobilization which cut our military strength to about one-tenth of its wartime peak. Our allies did much the same thing. But the Russians maintained much of their wartime military strength and built up that of their satellites. With prodigious speed we switched from military to civilian production and went on to enjoy a rousing postwar boom—the greatest in our history.

This boom was in vigorous progress when, on June 25 last year, the Russian-sponsored North Korean army attacked South Korea. Our industrial production was rolling along at almost twice its prewar level. We had labor shortages in many key industrial areas. Under the impact of heavy buying all along the line, prices were climbing.

When the North Koreans smashed into South Korea they smashed into our national consciousness this fact: if we want a fair chance to save our national freedom from destruction by Communist aggression, we must race to restore some of the military power we had so speedily written off after World War II. And we must do it with our resources already very fully occupied with a boom in civilian business.

Program Small Compared to World War II

Compared with our military effort in World War II, the mobilization on which we are now embarked is small. At its peak, under present schedules, it will absorb no more than one-fifth of the total national production. During World War II we reached a point when nearly half of our total production went for war-making.

Moreover, our economy now is much bigger and stronger than it was in World War II. During the last decade there has been an increase of about 15 percent in our labor force. Our workers have had the training advantage of steady employment. The capacity of our industrial establishment is two-thirds again as great as it was ten years ago. Since the war no less than $70 billion has been spent to expand and modernize it.

Given time, the industrial giant we have created could pick up in its stride the added load of production for defense that now is con-

templated. But speed is of the very essence. There is little dissent from the proposition that if we are to stand off Russian aggression successfully we have, at the outside, two years in which to get ready.

Controls Needed to Prevent Chaos

These two facts – (1) the necessity for speed in our rearmament program and (2) an economy already stretched taut by a record civilian boom—create the general necessity for government controls. If we simply pile the billions of added defense expenditures authorized since last June on top of the civilian boom, and let it go at that, two destructive developments would follow. There would be a scramble for scarce materials, notably metals, which would create chaos in those markets. And prices would go through the roof.

Our situation during this mobilization is radically different from what it was when we rushed to get ready for World War II. Then we started with an economy that was coming out of a long depression. There was plenty of slack. Even in mid-1941 we still had over 6 million unemployed. Thus it was possible for us to expand war production greatly and also increase civilian living standards before the limits of our productive capacity made extensive controls necessary. But as we begin this new mobilization we find our economy already operating virtually at capacity. This fact is of key importance in understanding why this relatively small defense program so quickly requires the imposition of controls.

The selection and administration of controls thus far has been badly bungled. The threat of price controls, for example, was broadcast so vigorously and for so long that our people were virtually asked to raise prices and thereby do much to defeat the controls. Adequate taxation directed so as to attack inflation at the source and thus give direct price control a chance to operate has not yet been provided.

Indeed, we could readily assemble a long and devastating catalog of the deficiencies of the government's control program. But that would not dispose of the necessity for controls – by priority, by allocation, and, as a stop-gap, by direct prescription of selling prices – if we are to carry out our mobilization successfully. That is the only means by which a clear right of way for defense production can be cut through the highways of trade and commerce now jammed with civilian boom business.

Hope In The Wilson Plan

Since he became Director of Mobilization, Charles E. Wilson has added a new element of order and hopefulness to the mobilization program. He has laid out a plan which, if we are spared all-out war, would do three things by 1953. First, it would produce the weapons needed by our army and our allies to meet an immediate threat. Second, it would create the capacity that would enable us to move at high speed into weapons production for all-out war – if necessary. Third, it would create the additional production capacity that would restore by that date our ability to resume the climb of the American civilian standard of living.

In technical and industrial terms the Wilson Plan seems to be feasible. If it is successfully carried out, we should be able to begin getting rid of controls rapidly by 1953. But to carry out the program successfully, it must now have vigorous support from everyone. That does not mean mere agreement that it is a good plan. It means that we must conform to the controls that are necessary to make the plan work. In developing this support, the business community is in position to exercise crucially important leadership.

As has often happened in our national history, we are confronted by a paradox. We must accept emergency controls for the time being to insure survival of the freedom that they infringe. But, as we do this, we may find some comfort in the reflection that while controls from Washington are hateful, controls from Moscow would be infinitely worse.

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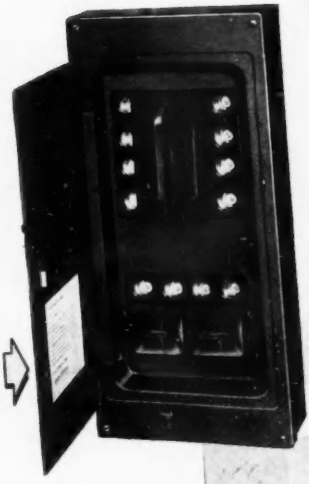
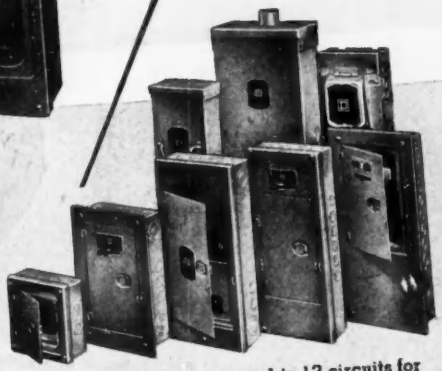
PARALLEL MAINS
Available with three, 3 wire, 30 or 60 ampere pullouts with 4, 6 and 8 plug fuse branches



SERIES MAINS
100 ampere pullout controls two, 3 wire, 30 or 60 ampere pullouts with 8, 10, or 12 plug fuse branches

Adds to Square D's extensive line of fusible service entrance equipment—designed to meet the increasing demands of modern "electrical living"



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FEATURES:

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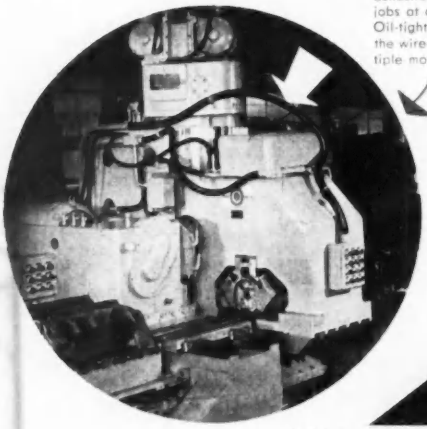
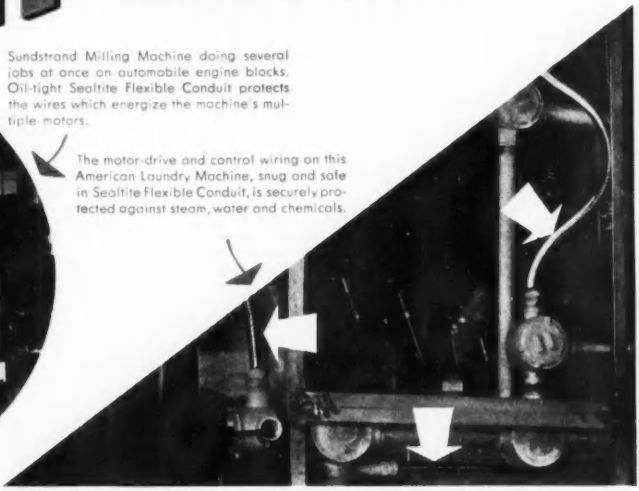
To make the wiring as good as the machine

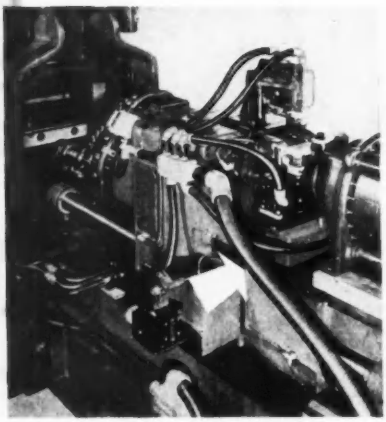
SEALTITE FLEXIBLE CONDUIT



Sundstrand Milling Machine doing several jobs at once on automobile engine blocks. Oil-tight Sealtite Flexible Conduit protects the wires which energize the machine's multiple motors.

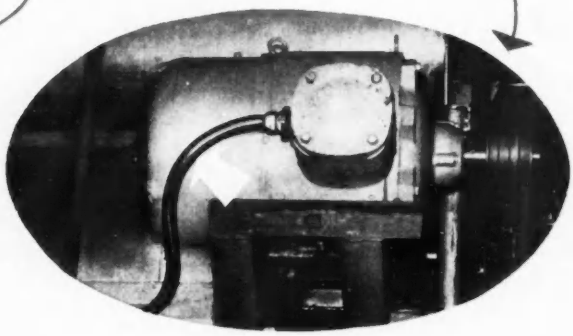
The motor-drive and control wiring on this American Laundry Machine, snug and safe in Sealtite Flexible Conduit, is securely protected against steam, water and chemicals.





Barnes "Automatic" machine tool for drilling and finishing automobile engine blocks. Sealtite Flexible Conduit carries wiring to motor and control relays operating machine turret.

Sealtite Flexible Conduit encloses motor leads on this California Packing Corporation canning plant conveyor . . . safeguards wiring from damage by fruit acids, provides flexibility for belt take-up.



For sure protection of machine wiring, run it in Sealtite* Flexible Conduit. Sealtite – with a liquid-tight synthetic jacket over strong, flexible galvanized steel tubing – can resist impact, abrasion, oil, water, steam, chemicals, etc. Its flexibility simplifies connections, especially where small or infrequent movements are involved.

Sealtite comes in long random lengths, is easily cut and assembled on the job. It uses standard rigid conduit fittings, is available from your electrical supply house. Bulletin C-188 will tell you how Sealtite's flexibility can solve many wiring problems. Send for it now. The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Company, Ltd.

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for **flexible, liquid-tight** electrical conduit . . . specify

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"It's just what the doctor ordered," say linemen and electricians. Gold Seal Tape tears evenly, quickly . . . will not dry out, peel, or ravel (production is laboratory-controlled to assure lasting "tack" in the friction compound). *Goes further*, too—there's no *waste* with Gold Seal. Produces not only better-taped joints, but more joints per roll. Buy it in handy cartons of 10 or by the roll. Each roll is cellophane-wrapped — *factory-fresh*. Jenkins Bros. (Rubber Div.), 100 Park Ave., New York 17.

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In either 10-roll cartons or single rolls. Every roll cellophane-wrapped.

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Whenever you have an electric current "blow", you restore your "ECONOMY DE-LAY" Renewable Fuse to its original efficiency by inserting an "ECONOMY DE-LAY" Renewal Link, in the same cartridge.

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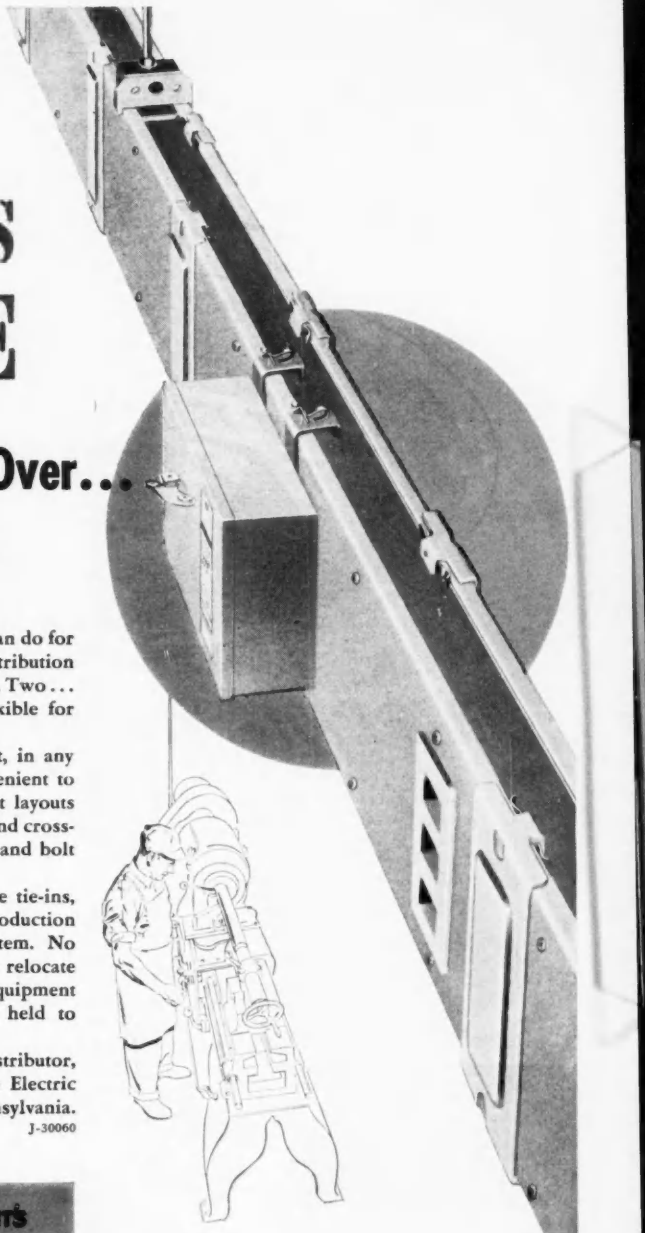
BUS DUCT IS FLEXIBLE

For Fast Tool Change-Over...

A Plug-In Every Foot



Here are two big jobs Westinghouse Bus Duct can do for you. One . . . provide a secondary power distribution system that is quickly and economically installed. Two . . . provide power at the point of use that is flexible for change-overs at any time.

Prefabricated sections of Westinghouse Duct, in any required length (10-foot maximum), are convenient to handle and mount. Ordinarily difficult or tight layouts are no problem with standardized tees, elbows and cross-overs. Simply suspend with cantilever hangers and bolt units together.

Plug-in receptacles every foot speed machine tie-ins, simplify the job of changing over or adding to production lines—without changing the distribution system. No wire mazes to unravel. No cable to splice. To relocate duct, just dismantle, rearrange, remount. All equipment is salvageable. Production line down time is held to a minimum.

For the full story, call your Westinghouse distributor, or write for Manual B-4272-A, Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.

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BUS DUCT

DESIGN TESTED AND VERIFIED IN THE Westinghouse HIGH POWER LABORATORY

Stab-lok
NBS 320L
20-circuit
Panelboard

Make more money with Stab-lok

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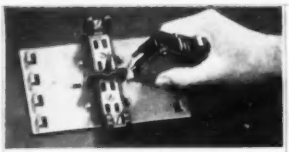
CLINCH more and more business! Give your customers today's safest, most convenient circuit protection at amazingly low cost . . . with the Federal Noark STAB-LOK system!

Here's how it works. You get the necessary STAB-LOK components from your authorized Federal wholesaler. All you need is the right-size STAB-LOK enclosure and STAB-LOK Circuit Breakers of the required ratings. Simply plug in the self-locking breakers and the unit's complete for installation in a matter of seconds.

There are nine STAB-LOK enclosures, with capacities of from 1 to 20 circuits. Most of them are the Noark "combination" type for either flush or surface mounting. All suitable for service equipment have an insulated groundable neutral. STAB-LOK Circuit Breakers come in a standard calibrated range of from 15 to 50 amperages, single or double pole.

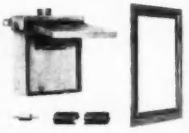
Start cashing in today with the STAB-LOK System. The huge circuit protection field is wide open for this modern, profitable development. Write for the whole STAB-LOK story. Federal Electric Products Company, 50 Paris Street, Newark 5, New Jersey.

Stab-lok OUTMODES ALL POPULAR FUSIBLE EQUIPMENT UP TO 60 AMPS.



To insert STAB-LOK Breaker, simply put end under hook and push into place. Stabs make instant contact and are locked in place without screws.

Single pole STAB-LOK with micromatically calibrated metal heart. Only one solderless terminal... resets automatically.



STAB-LOK line includes raintight devices, handle extensions, handle ties and adapter frames for easy flush mounting.

STAB-LOK "Flush-Surface" Enclosures are delivered with picture-type frame in place and ready for surface mounting. For flush mounting, discard frame.

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Complete line of Federal Electric Products includes Motor Controls, Safety Switches, Service Equipment, Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct ★ Sales offices in principal cities.

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SMART BUYERS KNOW it's the *installed cost* of electrical fittings that counts... not the purchase price! And that's where Gedney Fittings come in. Gedney's slash installation time and expense. They're machined and threaded with utmost accuracy. They're made of unbreakable malleable iron. Many are hot dip galvanized, the surest safeguard against corrosion . . . For longest profits on the completed job, order Gedney Fittings now!

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★ **Gedney One-Hole Conduit Strap...**

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★ **New Gedney Nest Back . . . a handy supplementary spacer . . . nests securely behind Clamp Back.**

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For more light per lamp, more light per watt
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QUALITY COSTS LESS

Fluorescent lamps are designed for starting and operating at specific values of electrical power. When these values are accurately maintained by a quality ballast, the ratio of light output to power input is high —you save money because the lamp is operating at peak efficiency. Improper operation with a poor ballast means *lower* light output, and *shortened* lamp life.

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More light output from fixtures powered by G.E. Ballasts means initial investment is less to obtain the same level of light. Longer lamp life means a yearly saving on maintenance and replacement costs. More efficient operation means a saving in power costs for the same light output.

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QUALITY ELECTRICAL TAPES

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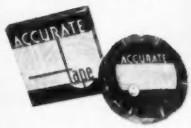

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Thin caliper reduces bulk in tight spots. Strong mechanically and offers high dielectric strength. Recommended for use wherever plastic tape is practical.

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Use rubber tape that coheres without heat or extra pressure. That's Accurate Tape! Easier to apply and actually improves with age. Remember—it's Accurate Rubber for greater electrical strength, Accurate Friction for positive mechanical protection!

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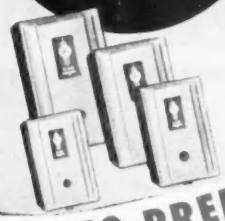
the AC MOTOR STARTER

that gives you MILL TYPE HEAVY DUTY CONSTRUCTION and DESIGN



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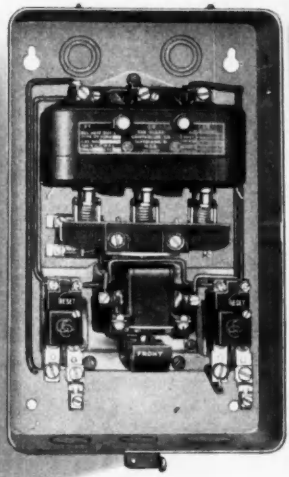

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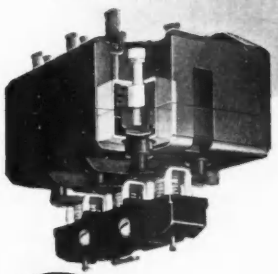

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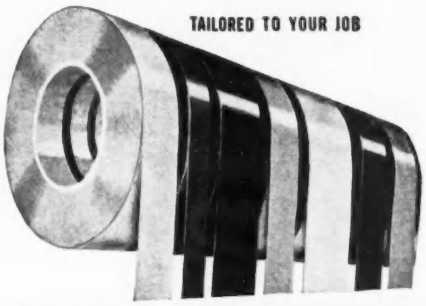


Sealing the cargo compartment of a pressurized plane cabin with *Polyken* No. 223

The tape that put a safety belt around an airplane's air!

Thanks to pressurized cabins—and a new kind of tape—the only breathtaking thing about the high-altitude flights of Braniff International Airways is . . . the service and the scenery.

Yes, we said *tape*. For tape has proved to be not only the best but the most *economical* material for sealing up door cracks, seams, and all air "escape" routes around a plane's pressurized cabin. For a job as vital as this, Braniff sought out a "tape tailored to the job."

Our engineers suggested *Polyken* No. 223. This tape, one of over 100 special *Polyken* tapes, sticks and *stays* stuck—in hot or cold, at ground level or 20,000 feet up. What's more, its tough cloth backing conforms to irregular surfaces and is extremely resistant to abrasion.

Small wonder that *Polyken* No. 223 is the tape specified for this important job on Douglas Aircraft today.

Got a tough job for tape?

We tell you the Braniff story as an example of how tape that's "tailored to your job" can do things you never dreamed tape could do. Let us study *your* problem, and we'll come up with a tape that will save you money, time and effort. That's a challenge. Won't you take us up on it?

GET THIS FREE BOOKLET! To help you find the tape "tailored for your job," write for your free copy of "Tape is a Tool." Address *Polyken*, Dept. ECF, 222 West Adams Street, Chicago 6, Illinois, or see your *Polyken* distributor.

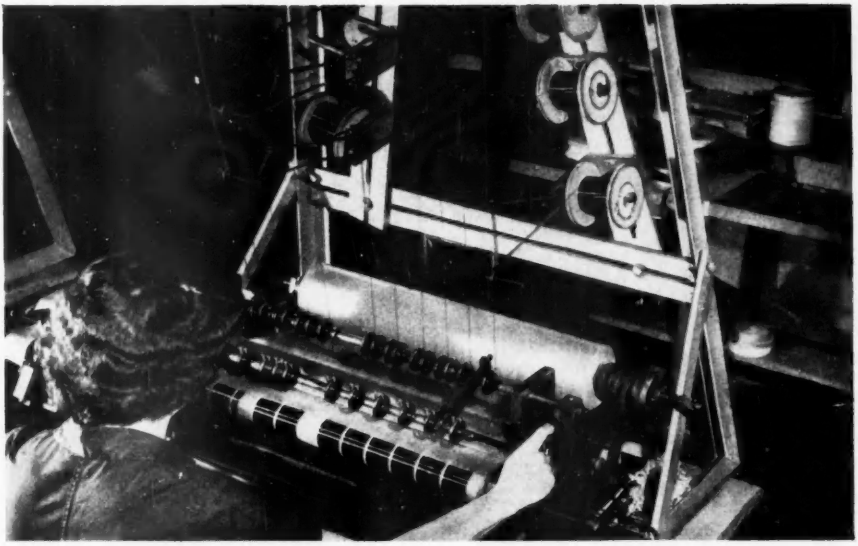
***Polyken* Industrial Tape, Department of Bauer & Black, Division of The Kendall Company**

MAGNET WIRE

Roebling Roevar retains its high dielectic strength under toughest service conditions

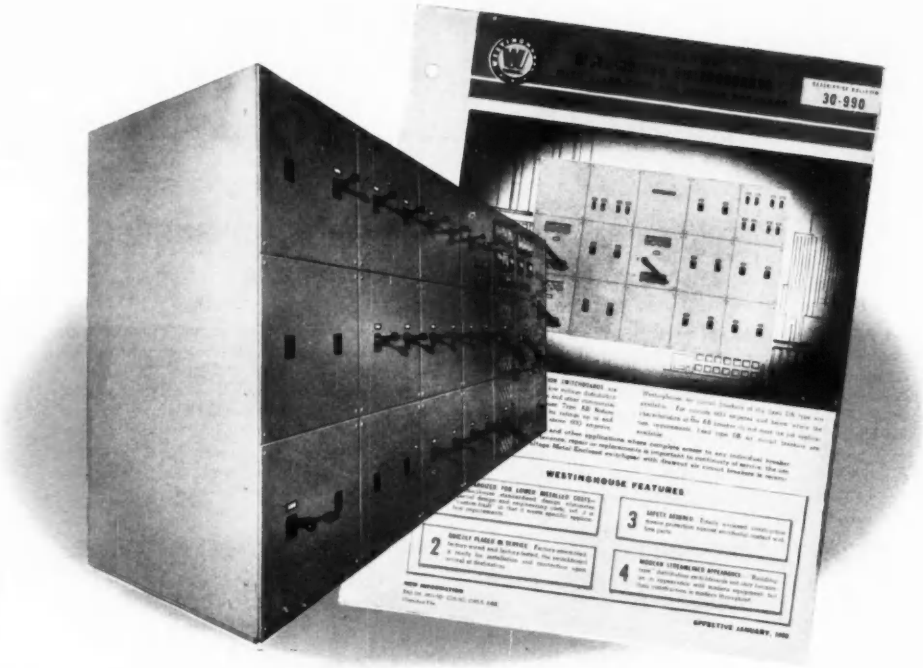
AT RELATIVELY HIGH operating temperatures, Roebling Roevar Magnet Wire has extraordinary resistance to the embrittlement, cracking and loss of toughness that cause damage to ordinary insulations. And besides that, Roevar is absolutely tops for high speed winding. Its insulation is 10 to 40 time more abrasion-resistant than conventional enamel . . . it bends and stretches to an exceptional degree without cracking or loosening from the conductor. It has a better space factor than wire with enamel and cotton, silk, cotton or paper insulation . . . and costs less, too!

A large share of Roebling's wide line of electrical wires and cables is required in the rearmament program, but we'll do our best to meet your requirements. Write today for full information and samples of Roevar. John A. Roebling's Sons Company, Trenton 2, New Jersey.



ROEBLING

Atlanta, 934 Avon Ave ★ ***Boston,*** 51 Sleeper St ★ ***Chicago,*** 5525 W. Roosevelt Rd ★ ***Cincinnati,*** 3253 Fredonia Ave ★ ***Cleveland,*** 701 St. Clair Ave, N.E. ★ ***Denver,*** 4801 Jackson St ★ ***Detroit,*** 915 Fisher Building ★ ***Houston,*** 6216 Navigation Blvd ★ ***Los Angeles,*** 216 S. Alameda St ★ ***New York,*** 19 Rector St ★ ***Odessa, Texas,*** 1920 E. 2nd St ★ ***Philadelphia,*** 230 Vine St ★ ***San Francisco,*** 1740 17th St ★ ***Seattle,*** 900 1st Ave, S. ★ ***Tulsa,*** 321 N. Cheyenne St ★ Export Sales Office, ***Trenton, N. J.***



Check these Advantages of Westinghouse "BUILDING-TYPE" Distribution Switchboards

Specifically designed for control of low-voltage distribution circuits in commercial buildings, Westinghouse Building-Type Switchboards provide low-cost circuit protection with these advantages:

. . . Where Westinghouse Type AB Nofuze "De-ion"® Circuit Breakers up to 600 amperes are suitable, these compact breakers keep cost and space to a minimum.

. . . Where circuit requirements are such that AB Breakers cannot be used, and for ratings above 600 amperes, stationary mounted Westinghouse Type DB Air Circuit Breakers are used.

Further, standardized design permits incorporating both Type AB and Type DB Breakers in the same structure.

Standardized design also makes installation easier, because switchboards are shipped as single structures or complete boards, depending upon your handling facilities.

Bulletin D.B. 30-990 gives the complete story on how to figure your requirements quickly and simply.

You can make selections right from this catalog. Structural numbers, operating parts and assemblies with layout instructions are illustrated, described.

Your Westinghouse representative will be glad to give you a copy of the booklet, or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-93468

YOU CAN BE SURE... IF IT'S
Westinghouse

"Building Type" Distribution
SWITCHBOARDS

A user REPORTS...

After their satisfactory experience with the 500,000 C. M. insulated aluminum cable (at right), National Supply Co., Torrance, Cal., says, "We will seriously consider aluminum when similar installations are planned." These cables, insulated with RH 600 v. U. S. Paracore, are connected to bus, from which they carry current to distribution panels for such heavy loads as welding machines, shears, rolls and other equipment.

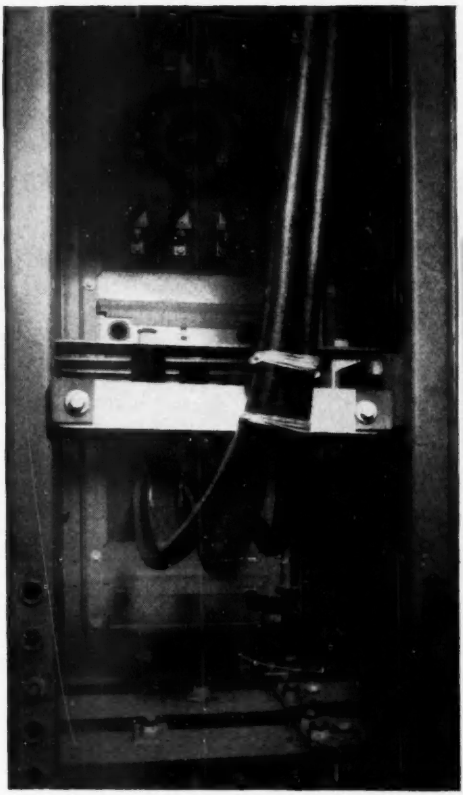


figure it in ALUMINUM and you figure it low

When you plan new production lines, add feeders for heavier loads, get prices both ways—in aluminum and in copper. You'll find you can make worth-while savings with aluminum . . . and installation is faster, easier because of aluminum's light weight.

Although the rearmament program restricts the use of aluminum, we are ready to help you with the planning for trouble-free, low-cost wiring.

FREE INSTALLATION BOOK

"Questions and Answers" on installation of aluminum conductors. Write for it now — Aluminum Company of America, 1775F Gulf Bldg., Pittsburgh 19, Penna.

Aluminum Conductors

ALCOA

of ALCOA EC ALUMINUM are made by leading manufacturers

NEW--

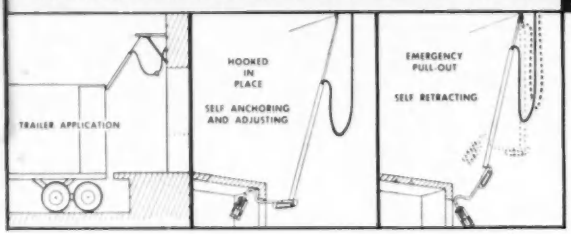
ANCHORLITE*

TRADE MARK

THE SUSPENDED *INSIDE AND UNDERSIDE* ILLUMINATOR

*PATENT No. 2,538,655. OTHER PATENTS PENDING

BETTER LIGHT FOR AUTO INSPECTION AND REPAIR



ULTRA CONVENIENCE IN TEMPORARY LIGHTING

REDUCES MAINTENANCE AND REPLACEMENT COSTS

REDUCES FIRE AND ACCIDENT HAZARDS

Only the Pyle-National Anchorlite completely answers your need for a convenient, economical source of good lighting, temporarily required in auto repair shops and service garages—in fact, anywhere where inside and underside illumination is vital to efficiency. Anchorlite does away with hooks, reels and entangling leads. Self-anchored above any localized work area you choose, it is self-retracting and self-adiusting. Spring tension anchors it in position for use without other means of holding, takes care of height variations up to 3 feet; should the auto move, Anchorlite releases itself automatically! It is suspended overhead where it is out of the way, yet always convenient and easy to reach when needed. It is also designed to be suspended from a messenger wire on which it can slide the full length of the garage.

Write for Anchorlite Bulletin

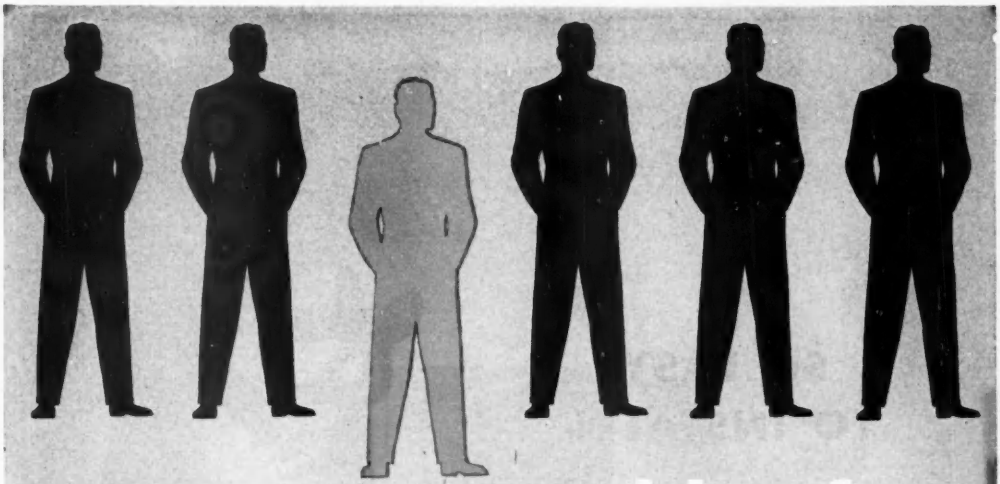
THE PYLE-NATIONAL COMPANY

1344 N. KOSTNER AVENUE • CHICAGO 51, ILLINOIS

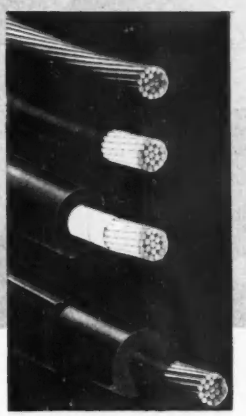
BRANCH OFFICES AND AGENTS in principal cities of the United States and Canada. EXPORT DEPARTMENT: International Railway Supply Co., 30 Church St., New York. CANADIAN AGENT: The Holden Co., Ltd., Montreal

SINCE 1897

PLUGS & RECEPTACLES • FLOODLIGHTS • TURBO-GENERATORS • CONDUIT FITTINGS • MULTI-VENT AIR DISTRIBUTION



we pay him for your protection



He's the one man out of every six at Okonite who is engaged in testing and inspection...a remarkably high ratio. In a sense, he's your inspector – for he's your assurance that the Okonite cable you buy is as nearly perfect electrically as can be made.

For example, in the manufacture of Okolite-Okoprene cable, here are a few specific instances of how these experienced testing and inspecting men at Okonite protect your cable investment:

... Immediately after mixing, a sample of every individual batch of insulating compound is vulcanized and laboratory tested to check formulation and required characteristics, before any further processing can take place.

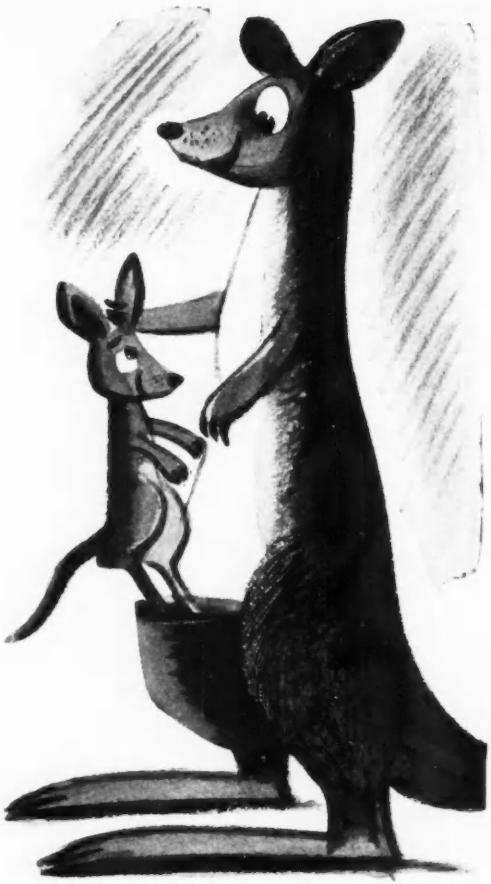
... A recently-developed technique permits electrical testing of every foot of the insulating compound strips *before application* to the conductors. This is another advantage of the Okonite strip-insulating method, used in making all Okolite-Okoprene cables.

... Every foot of Okolite-Okoprene is subjected to super-voltage a-c and d-c tests to check out even the tiniest concealed imperfection. These super-voltage tests are the most severe in the entire cable industry.

These are just a few of the complete testing and inspection steps taken at Okonite that assure you the extra circuit protection and long life you expect when you buy Okolite-Okoprene cables. **Write for Bulletin** EC-2009 which contains detailed information about Okonite's unique manufacturing methods and policies. The Okonite Company, Passaic, N. J.

THE BEST CABLE IS YOUR BEST POLICY

OKONITE SINCE 1878 ***insulated wires and cables***



SO EASY TO INSTALL!

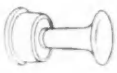
Beat the clock and you beat overhead. That's another way of saying—use Edwards. Edwards equipment is so easily and quickly installed . . . you save time, trouble, man hours on every job. That goes for maintenance, too. Rugged, dependable, trouble-free, Edwards installations require only minimum servicing. And when they do, the same simple-as-ABC design makes them equally profitable to maintain.

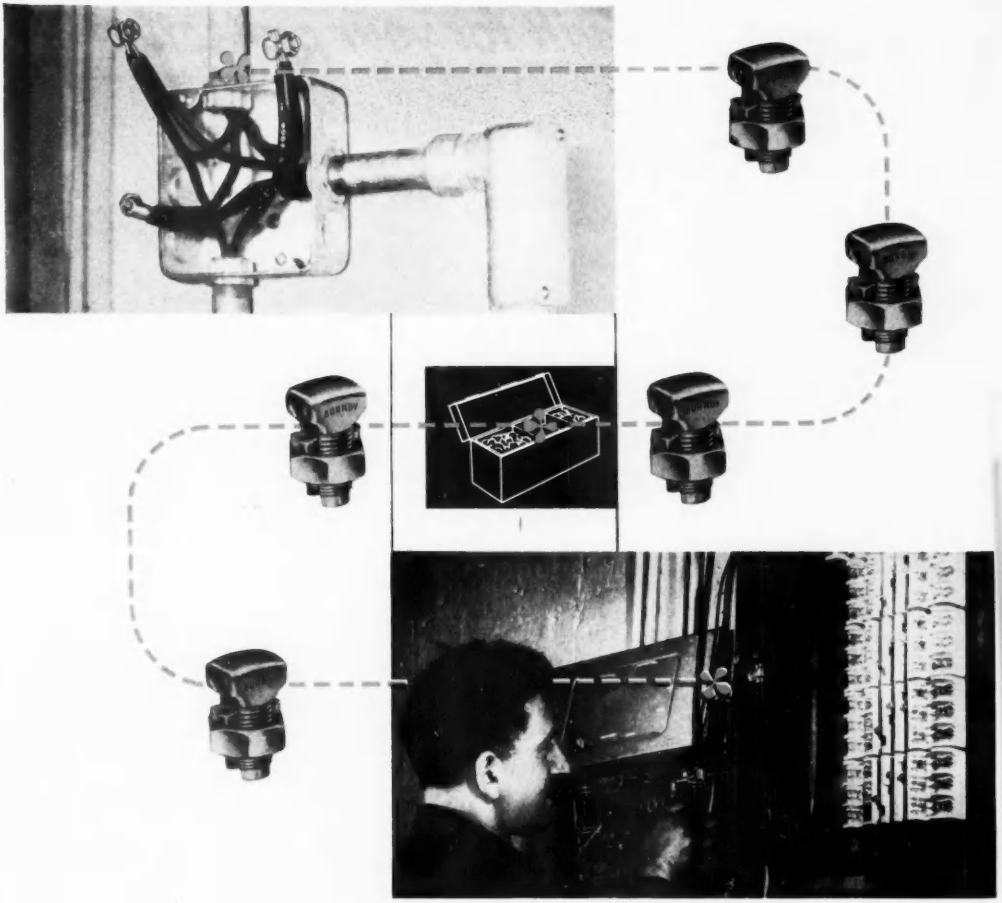
Your time is money. Save it with Edwards, the equipment that for 79 years has spelled dependability. It's designed to help *you* make more profit. For proof, write today to Dept. E-6, The Edwards Company, Inc., Norwalk, Conn.

Your time is money . . . save it with Edwards

EDWARDS

World's Most Reliable Time, Communication and Protection Products





here's a connector that lives a DOUBLE LIFE!

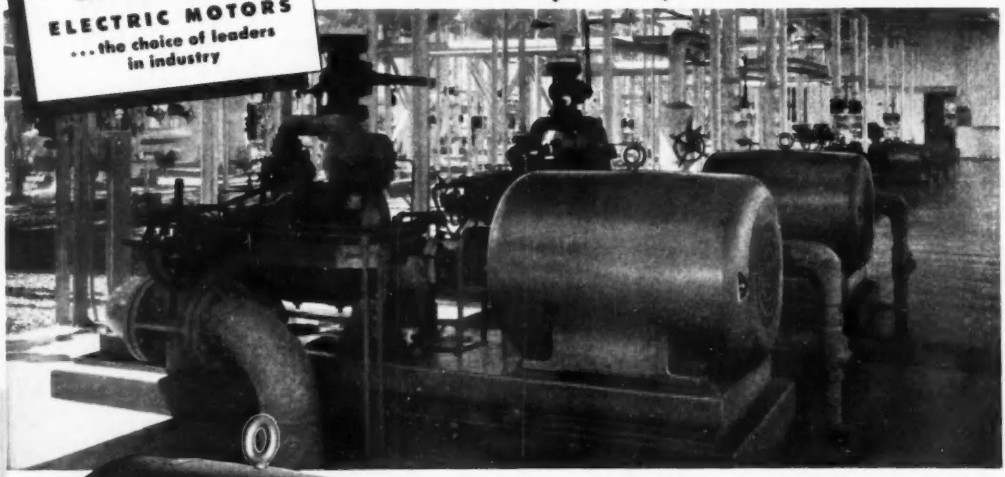
Burndy connectors are strongly constructed of high-grade, non-corroding alloy with husky, sharp, uniform threads. That's why you can use Burndy connectors over and over again for *temporary* or *permanent* installations. Today, it's most important to conserve stock. Make your supply go further, save time, reduce costs and be sure of sound connections: *use* Burndy connectors . . . *re-use* Burndy connectors!

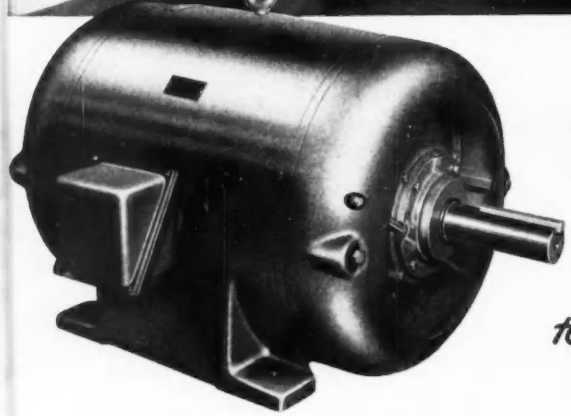
BURNDY CONNECTORS

BURNDY, New York 54, N. Y. • Western Branch: Vernon 58, Cal. • Burndy Canada Ltd., Tor. 8, Ont.

Wagner
ELECTRIC MOTORS
...the choice of leaders in industry

Built for your protection...





Wagner

Cast-Iron Frame MOTORS

totally enclosed...fan cooled ...corrosion-resistant

These totally-enclosed fan-cooled motors are built to take it—destructive elements, dirt or dust, acids or fumes don't interfere with their dependable operation.

Wagner cast-iron motors are especially suitable for installation in steel mills, mines, chemical plants, refineries and for other applications where corrosion is a problem, because practically all exposed parts are made of heavy, corrosion-resistant cast iron.

Where protection against explosive atmospheres is required, an explosion-proof design (type JP) can be furnished. Both the standard totally-enclosed type and the explosion-proof type are available in ratings from 2 to 250 horsepower, with either normal torque or high torque characteristics.

Wagner's new Bulletin MU-132 gives complete information on these fully-protected motors. Write for your copy today. Thirty-one branch offices, located in principal cities, are ready to assist you in any motor application problem.

®Wagner Electric Corporation
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MSI-10

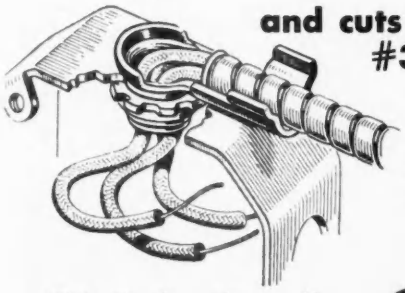
WAGNER ELECTRIC CORPORATION
6413 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES

New! ONE Screw Holds BOTH Cable and Cap...

and cuts your installed costs when you use #321...90° T&B Tite-Bite Connectors*



One twist—it's open
Slip off cap & insert cable
Slip cap on & tighten screw
... that's all!

Think of the time and money this new #321 Tite-Bite Connector will save on your wiring jobs. Only one screw! Twist . . . it's open—twist . . . it's closed—tight! Because this one single-turn screw holds *both* cap and cable, you do a faster, neater job every time.

"Tite-Bite" comes as a single unit . . . no loose parts to drop. Patented hook construction, case-hardened steel locknut and double thick bushing give you safe, sure, trouble-free installation every time . . . for all time! So insist on #321 Tite-Bite Connectors—the new *one-screw* connector that cuts your installed costs lower than ever before.

ENGINEERED RIGHT...
DISTRIBUTED RIGHT!

Tite-Bite Connectors are typical of the many T & B quality fittings recently re-designed to give you outstanding performance at lowest installed costs. Like all T & B fittings, they're furnished under the T & B Plan 100% through your local T & B distributor.

*patented

THERE'S A T&B ENGINEERED PRODUCT for every wiring job in the complete T & B line of fittings for all conductors and raceways.

UL

Remember, you always cut your installed costs by using T & B fittings . . . and by securing them through your local T & B distributor.

THE THOMAS & BETTS CO.

INCORPORATED
34 Butler Street,
Elizabeth 1, New Jersey

MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1899

HERE'S PROOF

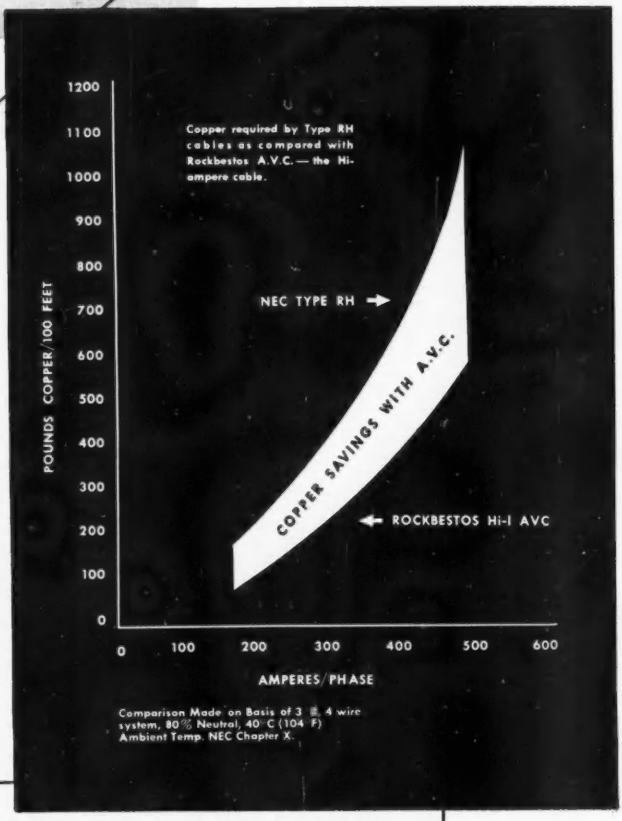
1 lb. of copper will do the work of 1.6 lbs. when you use

Hi $I = \frac{E}{R}$

ROCKBESTOS A.V.C.®

(CODE TYPE AVA)

Your best buy



Size for size Rockbestos A. V. C. carries more current than ordinary cables. And that's why it makes your critical copper and steel go farther.

You always use a smaller cable with Rockbestos A.V.C. Smaller cable requires *less* copper and smaller conduits and fittings on your power circuits. You save copper — save steel — save time and money.

Where voltage drop and power losses are critical, proper engineering allowances should be made.

Call your Rockbestos Application Engineer *today*. Ask for a copy of "Rx for a Building with Hardening of the Arteries."

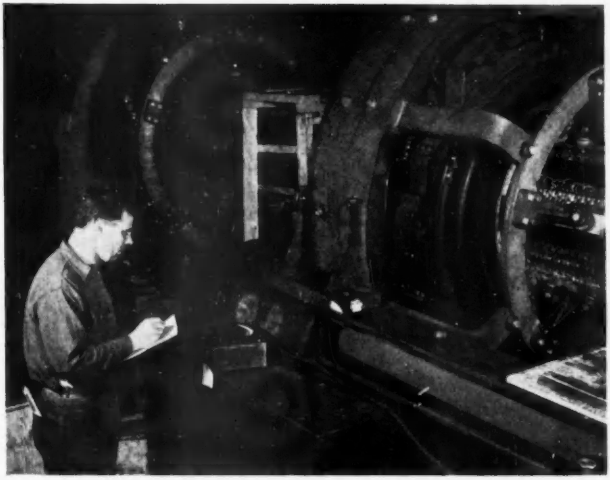
ROCKBESTOS PRODUCTS CORPORATION

NEW HAVEN 4, CONNECTICUT

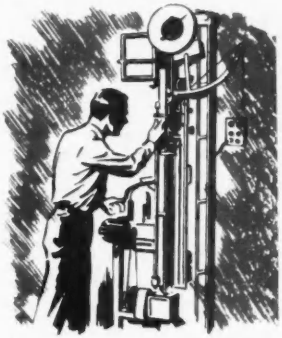
NEW YORK ST. LOUIS CLEVELAND LOS ANGELES DETROIT OAKLAND, CALIF CHICAGO PITTSBURGH NEW ORLEANS

Insulating News

News of G-E electrical insulating developments that can be important to your business.



Putting G-E insulating materials to the test in heavy industrial motors. G-E insulating materials are designed to permit operation of motors of all sizes under high temperatures and heavy loads for long periods of time.



Testing tapes for tensile strength. Quality-control tests through every stage of manufacture maintain the uniform high quality of General Electric Varnished Cloths and Tapes.

For original equipment or for rewinding, G-E insulating varnished cloths and tapes pave the way for long, dependable motor operation. *No equipment is better than its insulation.*

Quality of Varnished Cloths and Tapes Held Key to Successful Motor Repairs

No equipment is better than its insulation. And, in repairing electrical motors, the life of the repair job depends largely on the quality of the varnished cloths and tapes you use.

For many years, General Electric has been developing and producing varnished cloths and tapes for insulating G-E products. The same cloths and tapes which have helped make G-E equipment famous for dependability are available to you—at no more cost than ordinary materials.

These G-E cloths and tapes offer permanent flexibility, exceptional dielectric strength and high resistance to heat, oil and water. Rigid *quality control* means uniformity. You can build *extra* quality into every repair job . . . and build extra good will for your business . . . by using General Electric Varnished Cloths and Tapes.

Vital to Defense

General Electric insulating materials meet many of the requirements of vital defense production. The full line includes Insulating Varnishes, Silicone Insulation, Sealing and Filling Compounds, Mica Insulation, Varnished Cloths and Tapes. For specifications, prices, etc., write Section AB-2, Chemical Division, General Electric Company, Pittsfield, Mass.

Also look to G. E. for a complete line of laminated sheets, tubes and rods for insulation and other industrial uses.

You can put your confidence in

GENERAL ELECTRIC

(Advertisement)

BIDDLE

Instrument News

- ELECTRICAL TESTING INSTRUMENTS
- SPEED MEASURING INSTRUMENTS
- LABORATORY & SCIENTIFIC EQUIPMENT

NUMBER 8 OF A SERIES

JAMES G. BIDDLE CO., 1316 ARCH ST., PHILADELPHIA 7, PA.

MOTOR DRIVEN "MEGGER®" INSULATION TESTERS

Ranges up to 50,000 megohms at 2500 volts D-C.

USES

1. Where a number of tests are made at one location, as in testing separate conductors in telephone cable.
2. For dielectric absorption measurements on the insulation of generators, transformers and cables.
3. Where high resistance values need to be measured continuously, such as for indicating the moisture content of paper in production.
4. As a convenient source of low energy test potential at comparatively high d-c voltages.

Motor-driven "Megger" Sets are simple to operate, direct-readings by pointer deflection, rugged and portable; and they are of sufficient range and accuracy for most practical purposes.

DESCRIPTION

The motor-driven "Megger" Insulation Tester is similar to the well-known hand-operated set except that the d-c generator is driven by a motor which can be connected to a convenient outlet.

The generators in motor-driven sets have bearings and other features properly designed for motor operation. They are for continuous, or 24-hour duty. The driving motors which are rubber-mounted to reduce vibration are usually rated 1/20 hp, 115 volts, 60 cps. Other voltage and frequency ratings can be supplied.

The motor and its supporting bracket can be removed quite easily from the instrument case and the set made available for hand operation where an external source of current may not be available. This change can be made in the field.

For complete information write for *Bulletin 21-20-ECM.*

Photo courtesy Philadelphia Electric Co.

ELECTRICAL MEN IN INDUSTRY PREFER THIS DEPENDABLE AND RUGGED INSULATION TESTER

For average industrial requirements the Meg type of Megger® Insulation Tester is by far the most popular set we supply. This incomparable "trouble shooter" has ranges up to 2000 megohms with hand generators up to 1000 volts d-c. It is also supplied with a plug-in rectifier power supply either instead of or in addition to the hand generator.

The performance and endurance records which these instruments have achieved are difficult, if not impossible, to match in any type of portable testing device. For insulation resistance measurements—"Megger" instruments are the recognized standard.

Anyone can measure electrical insulation resistance in generators, motors, wiring and other electrical equipment with a Megger instrument—quickly—easily. Simply make connections, turn the crank and read the position of the pointer on the scale—no dependence on batteries or other source of test current; the built-in generator is always a ready and dependable source of supply.

Learn more about these "indispensable" tools today by writing for *Bulletin 21-45-ECM.*

HERE'S A "GOOD COMPANIONS" KIT FOR PRACTICAL ELECTRICAL ENGINEERS AND MAINTENANCE MEN

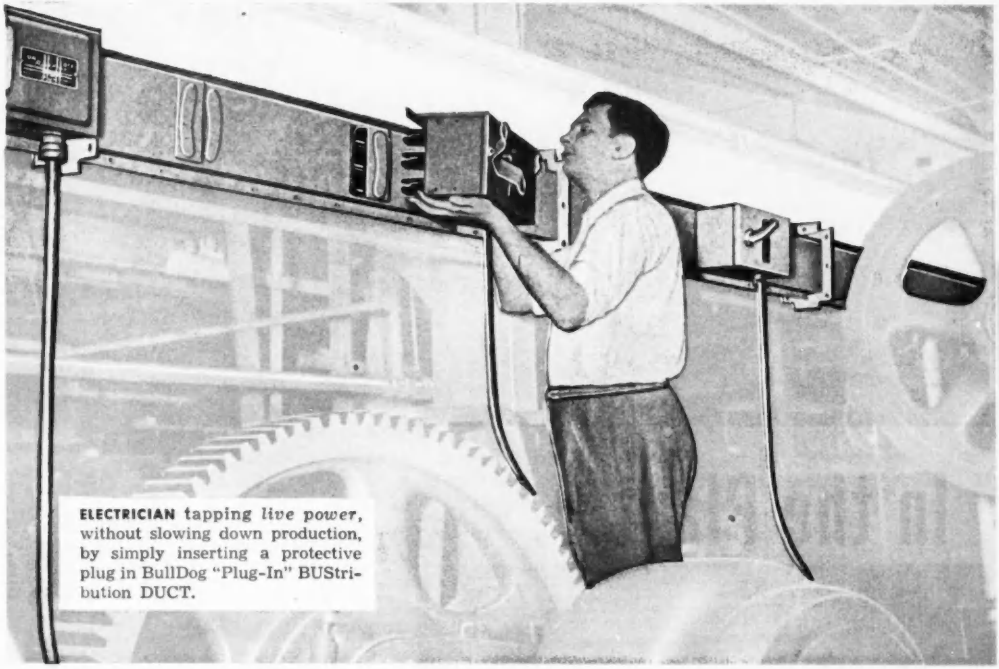
Men concerned with all-around-the-plant electrical tests and resistance measurements tell us that these are "indispensable" tools:

Midget Megger® CVM constant-voltage type of Megger® Insulation Tester for detecting dirt, moisture and deterioration in advance of failure, or as a trouble-shooter after failures occur.

The Midget Megger Circuit Testing Ohmmeter for measuring conductor resistance of coils, contacts and relays, and checking continuity of circuit and grounded parts.

Be sure to write for your copy of 21-85-ECM today.

Plug in "ON-THE-SPOT" POWER
. . . move machines anywhere, any time



ELECTRICIAN tapping *live power*, without slowing down production, by simply inserting a protective plug in BullDog "Plug-In" BUStribution DUCT.

Put extra profits in your production line with flexible BullDog BUStribution DUCT

HERE'S THE electrical distribution system that's right in step with your modern, expanding production facilities.

With BullDog "Plug-In" BUStribution DUCT, you can tap *live power* where you want it, when you want it. To move a machine, simply remove from the duct the plug that is feeding it electrical power. Move plug and machine to new location, and insert the plug in a convenient duct outlet.

It's as simple as that! Costly rewiring and expensive shutdowns of other machines are eliminated once and for all!

Your savings are threefold with flexible BullDog "Plug-In" BUStribution DUCT. Initial cost is low . . . practically no maintenance is required . . . safety and flexibility are at a maximum. Like all BullDog BUStribution systems, "Plug-In" DUCT is completely salvable . . . right down to the last nut and bolt.

Call your local BullDog Field Engineer soon for full information. He will be glad to show you an installation near your own plant.

BULLDOG ELECTRIC PRODUCTS COMPANY
DETROIT 32, MICHIGAN • FIELD OFFICES IN ALL PRINCIPAL CITIES
IN CANADA: BULLDOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO

BULLDOG

PIONEERS IN FLEXIBLE ELECTRICAL DISTRIBUTION SYSTEMS

FOR INCREASED EFFICIENCY—

In the Office...

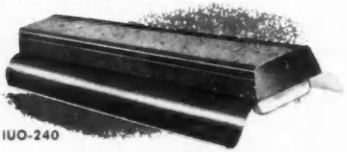
The *RIGHT* Light by LEADER

Industries participating in the new defense program must produce more for less cost in both office and plant. One of the most important factors in more efficient production is better lighting. Leader fluorescent fixtures for every lighting need are properly designed to give large amounts of efficient light without shadow or glare . . . the kind of light modern production requires for efficient operation. There is a Leader unit for every type of installation! Every Leader fixture is of finest quality throughout! For full information on the complete Leader line, write for catalog, TODAY.

In the Plant...

VL-440

The *"Officer"*—Leader's finest fluorescent fixture for all commercial interiors where beauty of appearance is as necessary as lighting efficiency. Available for 2, 3 or 4 40-watt lamps, also for Slimline lamps in lengths from 48" to 96". (VL-240, VL-340, VL-440; NHC-280, NHC-380, NHC-480)



IUO-240

The *"Stratoliner"*— Highly efficient, heavy-duty, all-steel industrial fixture. Removable end caps and turret-type sockets for easy servicing. Open and closed end models for 2 or 3 40-watt or 2 100-watt lamps. (IUO-240, IUO-340, IUO-2-100)

Sold and installed by the better electrical dealers and contractors.

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Leader® *America's No. 1 Lighting Equipment Manufacturer*

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Washington Report

NPA's open-end CMP, which goes into operation July 1, allocates steel, copper, aluminum to defense and defense-supporting production, leaves a "free" pool of what's left for autos, appliances, other non-defense consumer durables. Major consumer durable goods producers are pressuring for 100% CMP allocation for across-the-board production — defense and civilian.

Current NPA attitude: Use open-end CMP for 3rd quarter 1951 as planned, limit production of civilian consumer goods by M-orders to percentages of metals used first six months 1950. If "free"-pool supplies of the three basic metals proves inadequate, NPA will then allocate these metals to all producers. Estimated NPA steel cutbacks for 3rd quarter civilian goods: consumer durables — 65-70% of first half 1950 average; machinery and industrial equipment — near 100% of the '50 base; machine tools — about 135%.

A DPA Requirements Committee reviews over-all demands for CMP metals and other critical materials, recommends policies and programs for balancing supply with demand (P. 153). NPA expects level for electrical products will be established about June 15th.

NPA reorganization transfers the Electrical Products Branch from Building Materials Division to Electrical Equipment Division, to join other electrical Sections: Transformer, Pole Line Hardware, Small Motors, Generators. A Service Shops Section is also reported under consideration.

Protective lighting for industrial, military, municipal, and other facilities is becoming increasingly important as a "plant protection" measure against possible sabotage and espionage activities (P. 153).

New building construction first half 1951 will nearly top $15-billion, exceeding 1950 rate dollarwise. But six month's volume will about equal last year's rate. NPA's latest estimate is for about $27-billion this year, with volume down 10-15% from '50. Building scheduled under DPA-approved rapid tax write-off had exceeded $5-billion by May 1, during six month's period program had been in effect.

M-4 Construction Controls order amended May 3 put virtually all new building under NPA authorization (P. 153). Another amendment May 11 clarified provisions, spelled out certain exemptions.

Residential lighting demand will decrease this year, NPA told members of this industry's Advisory Committee recently (P. 154). The industry was also urged to turn in effective ballasts, old replaced lighting fixtures, etc., for copper scrap content now badly needed for defense program.

Electrical Contact Manufacturers Advisory Committee, meeting May 18, was asked by NPA to outline quantities of critical metals used in electrical contacts during 1951 1st quarter, classified broadly as to end use. Metals involved include copper base alloys, tungsten, steel, nickel, silver, molybdenum, cobalt, cadmium, and the platinum group.

Small business, eager to share in defense work or in need of assistance, can now obtain a useful "Mobilization Guide for Small Business" guidebook, telling how to get assistance—what to do—where to go.

A new weekly bulletin, "Defense Production Record", provides a compact roundup of week-by-week official actions taken by DPA and related defense agencies. It is available from Supt. of Documents, Government Printing Office, Washington 25, D. C., at $2.50 a year.

Cutler-Hammer Type D Safety Switches

I'LL ADMIT IT. I'M AMAZED TO FIND SO MUCH EXTRA VALUE AT NO EXTRA COST

Two things about the complete and comprehensive line of Cutler-Hammer Type D Safety Switches that impress electrical contractors and wholesalers most are the high quality of manufacture, and the dependability that keeps customers satisfied. These General Purpose Safety Switches that have ready acceptance for use with workshop tools, oil burners, stokers, laundry appliances, air conditioning and refrigeration units, feed grinders, compressors, etc., in homes, shops, farm and commercial buildings, and service entrance use, are built up to a standard of excellence, not down to a price.

Some of the features that mean better performance on the job are: "Easy-tight" wire holes on terminals that provide quick, solderless connections; inorganic base that will not carbonize or disintegrate, and dissipates heat from fuse wattage, resulting in cooler operation; double faced contacts with wiping, self-cleaning action that insure cool, continued performance; single break action with no needless overloading of switch mechanism; sturdy shock-resistant cases; provision for padlocking in the off position; ample concentric knockouts; ample wiring space.

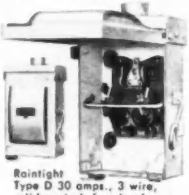
When experienced electrical men want reliability, they insist on Cutler-Hammer Safety Switches, carried in stock by distributors everywhere.

CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee 1, Wisconsin.

Broad Range of Sizes, Types and Enclosures

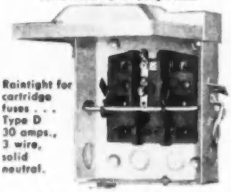
Type D 30 amps., 2 poles fusible, for plug fuses. Single throw.

Type D 30 amps., 3 wire, solid neutral, for plug fuses. Single throw.

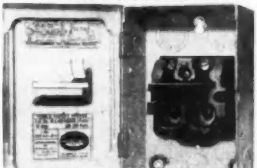


Raintight Type D 30 amps., 3 wire, solid neutral, for plug fuses.

For cartridge fuses . . . Type D 30 amps., 3 poles, fusible.



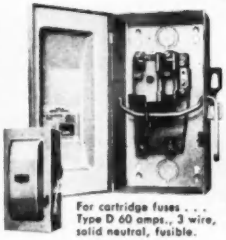
Raintight for cartridge fuses . . . Type D 30 amps., 3 wire, solid neutral.



D-Puller Front operated— Type D for plug fuses, 30 amps., 2 poles.

EXTRA VALUE AT NO EXTRA COST

CUTLER-HAMMER SAFETY SWITCHES C-H



For cartridge fuses . . . Type D 60 amps., 3 wire, solid neutral, fusible.

D-Puller Front operated— Type D for cartridge fuses, 60 amps., 3 wire, solid neutral.

JUNE . . . . at a Glance

New Controls

Forthcoming CMP rules out of Washington will impose closer controls over strategic materials and where they can be used. It will take time to note its effects on electrical materials, but in view of the continued high level of construction activity, some severe shortages are bound to be felt in the third quarter. It is too early to appraise the effect of bringing electrical wiring materials, under building materials in old WPB, into the electrical division of NPA (see Washington Report). Cautious comment so far indicates that considerations bearing on the new alignment were largely administrative.

Industrial Plug-ins

Frequent rearrangement of production equipment with resultant changes in load and voltage requirements are every-day problems in many industrial plants. A practical solution, using plug-in service panels and an overhead multi-voltage busduct system, is discussed by C. H. Ashbaugh, chief engineer for Mid-West Metallic Products of Cleveland, in the article, "Self Service Distribution", beginning on page 72.

Job Costs

With the second and concluding installment of "Incidental Labor and Direct Job Costs", page 68, Ray Ashley has presented important and challenging analyses of job costing for these times. Many of these considerations are familiar ground, but altogether too rarely do estimators develop their job costs on such a systematic method. Some may want to argue Ashley's precise percentages, but any others would have to be developed on an equally rigorous analytic method.

Adequacy in Industrial Wiring

What are the features which denote wiring adequacy and flexibility in an industrial plant? Requirements, present and future, vary substantially in different kinds of plants, in different areas within the same plant. They are best illustrated by case studies of actual installation of which "Utah Plant Wired for Adequacy" by Laurence E. Baty, page 65, is a good example. The work carried out at the Salt Lake City plant of the Chicago Bridge and Iron Co. by Oberg Electric Company is worth careful study and appraisal by everyone concerned with industrial wiring design and installation.

Rewiring

Thousands of industrial and commercial buildings in this country are 20 or more years old. Almost without exception, the electrical systems in these old buildings are frightfully overloaded, operating at excessive temperatures, and curtailing the use of additional utilization devices. Installation of air conditioning, new lighting systems, new motor loads, etc., is stymied until new capacity is made available. How G. Fox & Co., Hartford, Conn. department store, solved this problem economically and provided adequacy for future loads is told in "Rewiring for Added Capacity", page 76.

DATES AHEAD

American Institute of Electrical Engineers — Annual summer meeting, Royal York Hotel, Toronto, Canada, June 25-29.

New York State Association of Electrical Contractors and Dealers, Inc. — Annual convention, Saranac Inn, Saranac Lake, N. Y., June 30-July 7.

American Institute of Electrical Engineers—Pacific General meeting, Multnomah Hotel, Portland, Oregon, August 20-23.

Illuminating Engineering Society—National Technical Conference, Hotel Shoreham, Washington, D. C., August 27-30.

International Association of Electrical Inspectors — Southwestern Section, Long Beach, Calif., September 13-15; Northwestern Section, Spokane, Wash., September 19-21; Western Section, Hotel Fontenelle, Omaha, Neb., September 25-27; Eastern Section, Chalfonte-Haddon Hall, Atlantic City, N. J., October 1-3; Southern Section, Hotel John Marshall, Richmond, Va., October 15-17.

International Municipal Signal Association, Inc.—Annual convention, Mark Hopkins Hotel, San Francisco, Calif., September 17-20.

Canadian Electrical Manufacturers Association—General Brock Hotel, Niagara Falls, Ont., September 26-28.

National Farm Electrification Conference — Hotel Gibson, Cincinnati, Ohio, October 9-10.

National Electrical Contractors Association—Annual Convention, Shoreham Hotel, Washington, D. C., October 9-12.

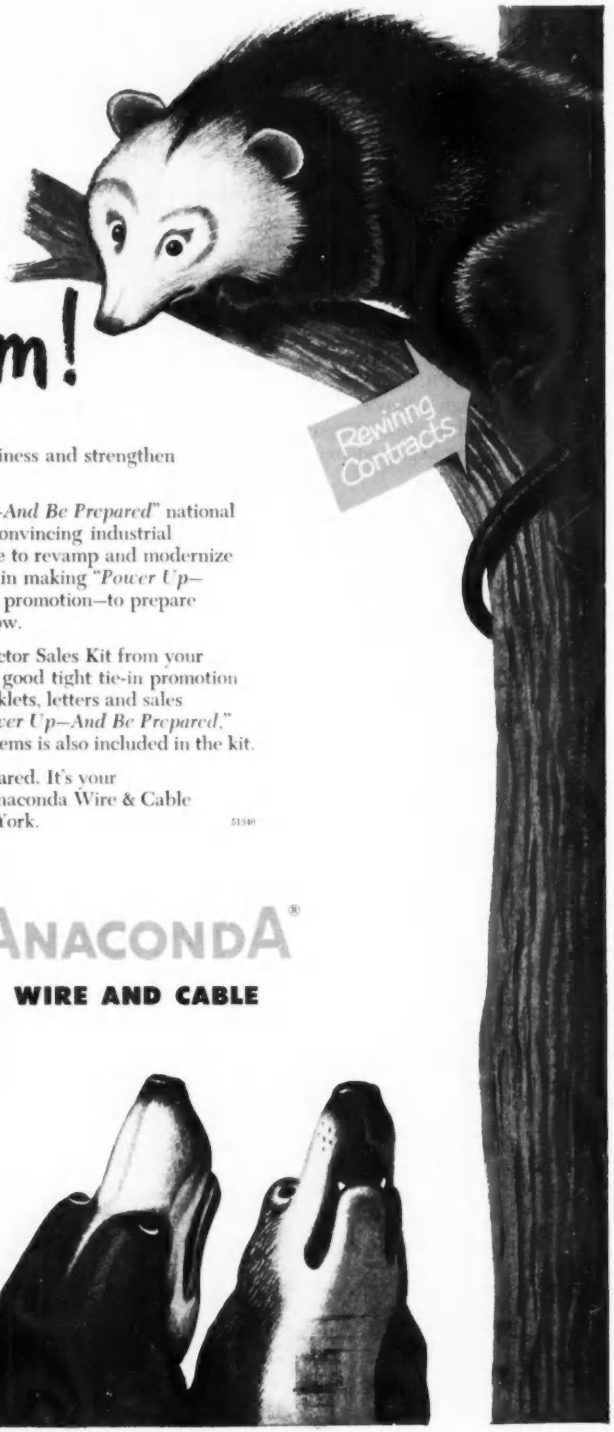
International Association of Electrical Leagues—16th Annual conference, Roosevelt Hotel, New Orleans, La., October 10-13.

American Institute of Electrical Engineers—Fall general meeting, Hotel Cleveland, Cleveland, Ohio, October 22-26.

National Electrical Manufacturers Association — Chalfonte-Haddon Hall, Atlantic City, N. J., November 12-15.

We tree em-

You get 'em!



Yes, here's your chance to build your business and strengthen America and America's defenses.

Anaconda's highly successful *"Power Up—And Be Prepared"* national campaign aimed at American Industry is convincing industrial leaders that now, more than ever, is the time to revamp and modernize plant wiring systems. Join other contractors in making *"Power Up—And Be Prepared"* your own highly charged promotion—to prepare Industry for its vital job today—and tomorrow.

Here's what you do! Get your free Contractor Sales Kit from your Anaconda wholesaler. Then, start making a good tight tie-in promotion of your own with the direct mail pieces, booklets, letters and sales helps contained in the kit. Your copy of *"Power Up—And Be Prepared,"* a complete guide to modernizing wiring systems is also included in the kit.

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

50th Year —JUNE • 1951

Air Conditioning Boom

ONLY A SERIOUS SHORTAGE of critical materials can prevent records in sales of air moving and cooling equipment this year. The industry developed a momentum during the past three years in public demand that shows no signs of falling off. Shortages of strategic materials may cut sharply the amount of equipment available, but enough will probably be marketed even under controls to hold an option on the progress already made.

MOST NOTABLE of recent developments is in the "packaging" of air conditioning apparatus. Most of the critical engineering is built in. Application and installation are simplified. Sales and service establishments have multiplied rapidly with widening market dvelopment as a result. Many electrical contractors and motor shops are leading dealers and service organizations for package air conditioning in their market areas.

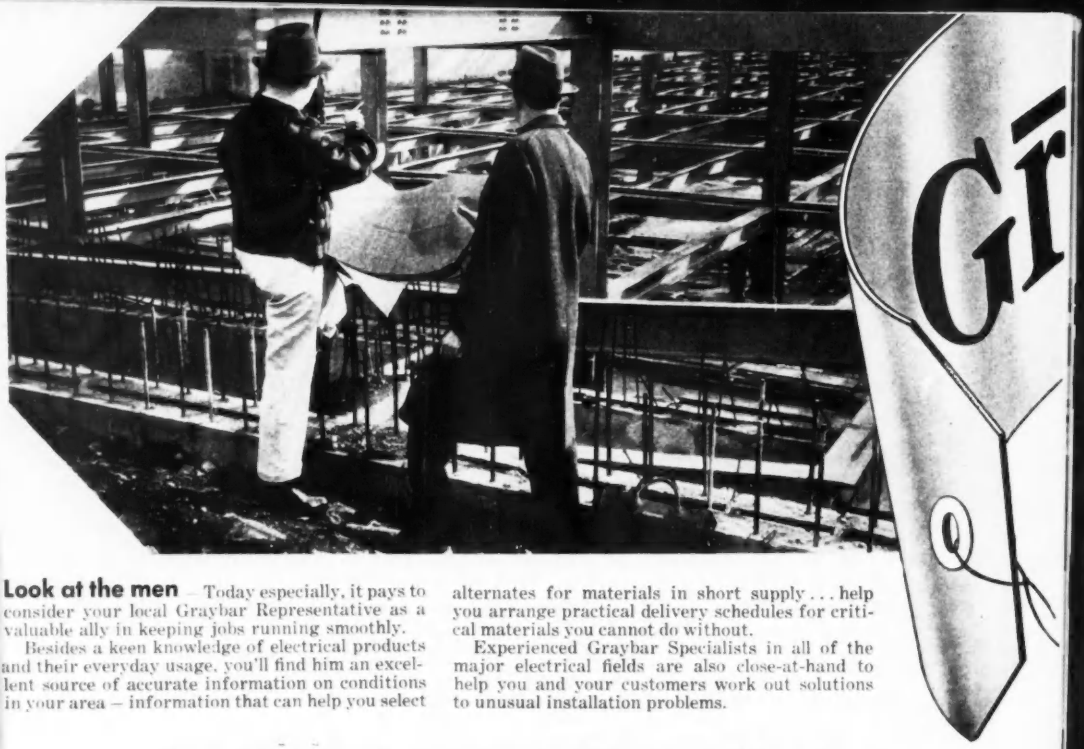
WINDOW AND CONSOLE TYPE room coolers have opened wide a tremendous residential air conditioning market. Long considered a luxury beyond the reach of average home owners, room coolers have brought residential air conditioning at a price comparable with other major home appliances. Installation is inexpensive and operating costs are modest.

THE INFLUENCE of air conditioning on wiring is impressive. A few of the smaller window mounted room coolers can be carried on existing wiring circuits and connected to plug receptacles. But most require new branch circuits and often a considerable alteration of feeders and panelboards. Loads are heavy and continuous. There are few diversity considerations in multiple unit installations. The capacity and efficiency of the apparatus is directly dependent upon adequate wiring design.

FOR AIR MOVING or exhausting, built-in ventilators, attic fans or even window mounted ventilators usually require their own outlet or plug receptacle and often wiring for remote control. Though less spectacular in wiring requirements than are cooling systems, air moving apparatus accounts for a very large amount of new wiring and alterations in total.

WHILE AIR CONDITIONING SALES are growing at a very healthy rate the still unreached market is enormous. Electrical industry people, whether they feel they are directly concerned with air conditioning application or not, have a real and important stake in its future development. We ought to lend every encouragement to its growth.

William T. Stuart



Look at the men – Today especially, it pays to consider your local Graybar Representative as a valuable ally in keeping jobs running smoothly.

Besides a keen knowledge of electrical products and their everyday usage, you'll find him an excellent source of accurate information on conditions in your area – information that can help you select alternates for materials in short supply . . . help you arrange practical delivery schedules for critical materials you cannot do without.

Experienced Graybar Specialists in all of the major electrical fields are also close-at-hand to help you and your customers work out solutions to unusual installation problems.

For solutions to your electrical problems–

Look behind the Graybar tag

Look at the materials

Graybar distributes products made by over 200 of the nation's leading manufacturers – a total of more than 100,000 different electrical items. On a single order, you can get all the materials, equipment, and tools required for wiring, lighting, ventilation, communication, and power installations.

Quotation service on these items is available without obligation to help you prepare estimates and meet job specifications.

Look at the methods

Modern inventory systems . . . a nation-wide network of warehouses . . . strategically located emergency stocks . . . daily analysis of the over-all supply picture – all these help your near-by Graybar office get materials to you *when* and *where* you need them.

Take advantage of this proven ability to deliver the goods – make it a point to order ahead . . . and to order "via Graybar". 172-46

GRAYBAR ELECTRIC COMPANY, INC.
Executive Offices:
Graybar Building, New York 17, N. Y.

Avoid electrical delays—plan ahead . . . via GraybaR

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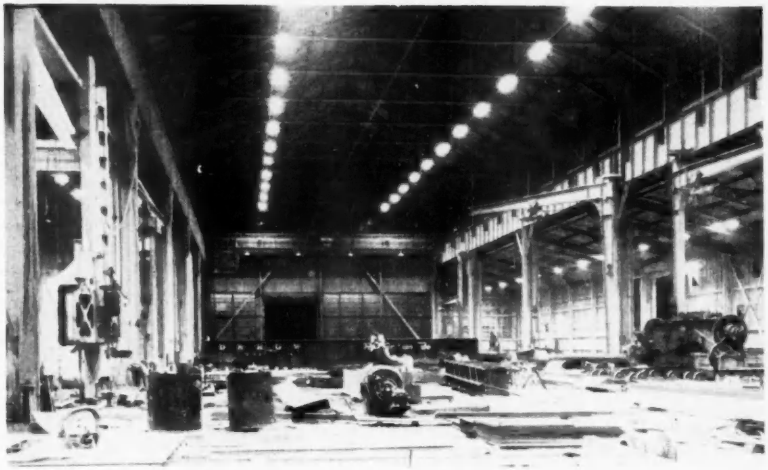


NORTH HIGHBAY AREA is lighted by twin unit reflectors using 2-400 watt mercury vapor lamps at 45-foot mounting height. Incandescent lighting is used in lean-to section at right and in low bay center section at left. Resulting illumination is ideal for plate steel fabrication.

Wiring a Small Plant for Adequacy

Oberg Electric Company installs electrical system featuring adequacy and providing flexibility in wiring and lighting for Chicago Bridge and Iron Company's plant in Salt Lake City, Utah.

By Laurence E. Baty

Engineer
Salt Lake City, Utah

Safety, flexibility, and future requirements influenced the electrical design for the Chicago Bridge & Iron Company Plant in Salt Lake City, Utah. Installation costs and operating losses, as well as a minimum list of maintenance parts, also were important factors.

This plant is devoted entirely to plate steel fabrication. Among the products are water towers, oil storage tanks, refinery tanks, etc. Location is at the hub of transportation facilities leading toward the Pacific Northwest, the Golden Gate, and Southern California. Good rail connections also extend to the East and a nearby source of raw material is the Geneva Steel Company.

Facilities consist essentially of a main manufacturing area of approximately 100,000 square feet (420 ft. by 250 ft.), with steel sheets on steel framing construction, a two-story plant office building of brick and concrete construction containing over 10,000 square feet, a pattern (template) shop two stories high of brick construction, and a single story brick construction shop office building. The plant has reached its present proportions by stages in the little more than three years since construction first began.

The total connected power load of the shears, punches, welders, cranes, rolls, presses, compressors, and other motor-driven equipment is in excess of 2425 hp. The largest unit is 150 hp. Aside from the smaller equipment, such as door openers, most units are wound for 480 volts, 3 phase. Direct current required by certain machines and equipment is supplied by individual motor-generator sets.

Seven substations, located at the load centers, are provided for the lighting load. Mounting is out of the way on building structural members. Primary distribution within the plant is at 480 volts. Secondary distribution voltage is 120/208, 3 phase, 4 wire. Transformers are all single phase, dry type, connected delta-wye. Individual sizes range from 7½ to 37½ kva. Total rating of substations is 390 kva. In addition, traveling cranes carry 10 kva. transformers for cab and floodlights.

High voltage equipment consists of two unit type substations, with 1000 kva, 12,000/480 volt transformers. The primary circuit breakers are rated at 600 amp with 75 amp trips. Two cables, rated at 15 kv, run underground approximately 170 feet for connection to the lines of the utility.

Main 480 volt switchgear consists of two totally-enclosed groups having draw-out type air circuit breakers. They are connected to the main substation by bus bars in metal housings. A 1350 amp., 3 pole, 600 volt, ventilated busduct connects the two groups.

Main secondary circuit breakers are 1600 amp with 1200 amp trips. Either switch group can be fed by either

transformer, but the two main breakers and the tie breaker cannot be closed at the same time. Interlock is provided by two removable keys for the three breakers.

Thirteen circuit breakers control the feeders extending from the switchgear. Depending upon the load, protection ranges from 225 to 600 amp. Ammeters, controlled by transfer switches, permit current readings on all phases of main and feeder circuits, except the Feederduct tie. Voltmeters are connected through transfer switches to each phase of the transformers.

Feeders

Between them, the two switch groups control three lighting feeders, four busduct runs, three crane feeders, two compressor feeders, and a combination lighting and power circuit to the plant office.

Distribution to the general shop equipment is by means of four runs of 600 amp., 600 volt, 3-pole busduct. Crane, lighting, compressor, and office feeders are in conduit.

The two primary services and the plant office circuit are run underground in 4-inch Bermico fiber conduit. Aside from the plant office underground circuit, and the busducts, all 480-volt wiring is in standard steel conduit. Fiberduct was used for telephone and convenience outlet circuits under the first floor of the plant office building. One run for each was laid along the center line of each half of the building. EMT was used in 120/208 volt wiring only.

In the main shop, temperature ranges in the order of 100 degrees can reasonably be expected between Summer and Winter. For this reason, no conduit or busduct runs extend more than 100 feet without an expansion joint. Suitable junction or pull boxes form the expansion joints in the conduit runs. Entering conduits do not have locknuts at the expansion joints. The ends are only bushed. Ground continuity is provided by bonding jumpers. Factory-made expansion joints were installed in the busducts.

Fixture wiring is asbestos covered. Type RH insulation was otherwise generally used, except that Type TW was used where exposed to moisture.

Circuit breaker panels, with 20 amp. breakers, were placed at all lighting load centers. Magnetic starters are used on the motors, although drum controllers handle variable speed requirements.

One traveling crane, primarily to serve a 300-ton press, is provided with two hoists and five motors. A set of switches and relays permits control from the floor. Twenty-three trolley wires, for the motors and limit switches, are strung below the building cross-framing.

The company installed collector rings on those jib cranes which are located where 360 degree rotation can be obtained. This scheme eliminates cord twisting and tangling. Also, swings greater than 180 degrees are not ordinarily required, thus reducing operating time.

Traveling cranes, with the conventional cabs, are located in the unloading yard and main shop areas.

A 20-ton locomotive handles the switching on the yard trackage. Standard gauge tracks, not connected with the yard trackage, extend into the shop. Loaded cars on these service tracks are pulled by electric winches set at the rail ends.

Roller conveyors are also used. The largest, approximately 80 feet long and 7 feet wide is operated by ten motors. It has moved loads of 20 tons.

In the electrical design, capacity of each motor branch circuit was provided for a motor one standard size larger than what was actually installed. Use of Type RH insulation gave greater capacity than lower grades. No telephone conduit was run in a size smaller than one-inch.

Expense was saved on busduct by buying in standard lengths and cutting in the field. When running the lighting conduit and wiring in the main shop, the contractor found the crane bridges to be convenient places to rest his stepladders.

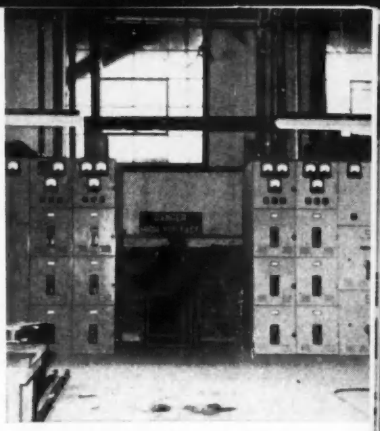
Lighting

The main manufacturing area consists of a low bay area 50 feet wide by 420 feet long, two high bay areas each 75 feet wide, one on either side of the center low bay area, and two lean-to sections each 25 feet wide, flanking the outer sides of the two high bay areas.

Mercury vapor lighting from twin 400-watt units was used in the two high bay areas. Each twin unit is served by a 400-watt twin transformer, or ballast. The North bay uses high bay reflectors with medium spread lenses, installed at 45 foot mounting height on 20 ft. by 36 ft. spacing. The South bay uses reflectors with wide spread lenses installed at 35 foot mounting height on 20 ft. by 34 ft. spacing. Maintenance is provided for from an 8-foot stepladder set up on the crane bridge.

The center or low bay section is lighted by 1000-watt RLM dome units,

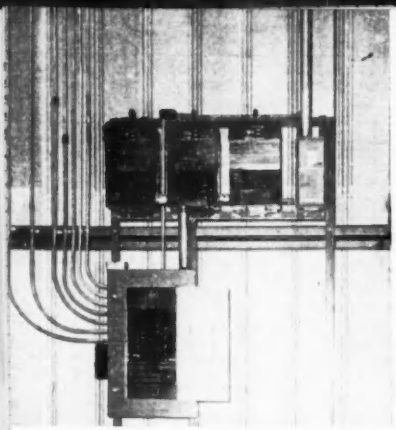
[*Continued on page* 160]



SWITCHGEAR for main 480-volt service consists of two totally enclosed groups with draw-out type air circuit breakers.

REMOTE CONTROLS for 5-motor bridge crane and 300-ton press, installed to permit complete control from the floor.

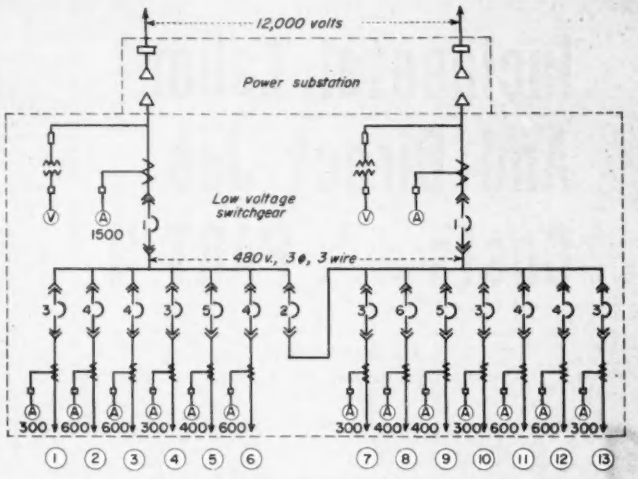
DOORWAYS are lighted for safety and protection with 200-watt "parabolite" reflectors. Small doors use one unit.



TYPICAL TRANSFORMER BANK for lighting, using three dry type transformers, 480-v. primary, 120/208-v. secondary.

TEMPLATE SHOP has special wood floor, is lighted to 50 footcandles with continuous row fluorescent reflectors.

FLOODLIGHTS ON CRANES are 1500-watt units, installed to rotate 360 degrees. Servicing is from crane walkway.



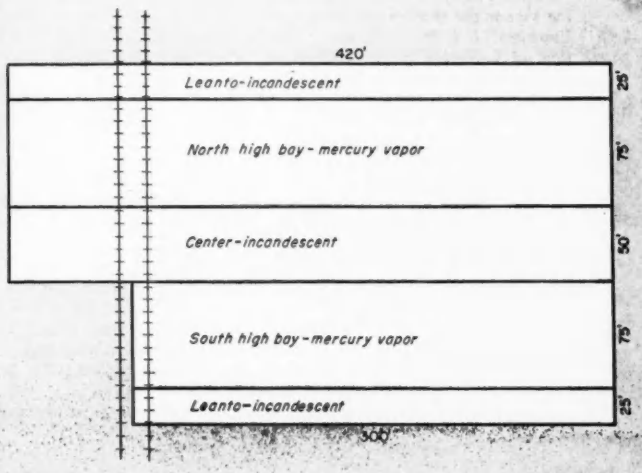
BRANCH DISTRIBUTION CIRCUITS

CONNECTED LOADS

1. 2 Ltg. banks, 67.5 kva.
2. Bus duct, 514 hp.
3. Bus duct, 575 hp.
4. 4 Ltg. banks, 120 kva.
5. 2 cranes, 50 hp.
6. Office Ltg., 112.5 kva., + 30 hp.
7. 2 Ltg. banks, 90 kva.
8. 2 cranes, 100 hp.
9. Compressor, 150 hp.
10. Crane, 50 hp.
11. Bus duct, 279 hp.
12. Bus duct, 567 hp.
13. 2 compressors, 110 hp.

MAIN SWITCHGEAR (Legend)

- High voltage switch, totally enclosed
- Transformer bank, 1000 kva., three phase, delta-delta, 12000/480 volt,
- 480/120 volt potential transformer
- 600 volt fuse
- Three phase instrument transfer switch
- Current transformer, 5 amp. secondary, primary rating same as connected ammeter
- (A) Voltmeter
- (V) Ammeter, 5 amp. coil, full scale noted on diagram
- Air circuit breaker, 600 volt



Incidental Labor And Direct Job Costs . . . PART II

By Ray Ashley
Research and Consulting Engineer
Chicago, Illinois

Direct job costs must be clearly defined in an estimate or be represented by percentages based on true costs. Here are methods of presenting and substantiating such costs.

PRICING SHEET — DATE NOV. 1

JOB OR BLDG. HALL PLATING — LOCATION STOCKTON HTS.
BID TO DO — ADDRESS DO
ARCHT. OR ENG'R ✓ — ADDRESS ✓
PLANS MARKED SEE T-1 — SCALE ✓ — SPEC. NO. ✓ — EST. No. 872

EST. BY	PRICED BY	EXTENSIONS BY	CHECKED BY	S.O. NO.	SHEET NO.

SHEET NO.	MATERIAL	QUANTITY	MATERIAL UNIT	MATERIAL EXTENSION	LABOR UNIT	LABOR EXTENS
	~ SUMARY & BID SHEET ~				HRS.	$
1	CONN AT PRES. SW BRD.			15 -	24	6
2	DISTR. PANELS			250 -	14	3
3	FEEDERS			350 -	60	15
4	POWER BR. WIRING			240 -	110	27
5	MOTORS - SET & CONN.			30 -	60	15
				885 -		67
	INCIDENTALS		2%	18 -	5%	3
				903 -		70
	INSPECTION - 8M - 90 HP			15 -		-
	INSURANCES - LAB (10% OF 70)			70 -		-
	OTHER DIRECT JOB COSTS		4%	36 -	12%	8
				1024 -		78
	OVERHEAD & ADMIN. EXP.		10%	102 -	35%	27
				1126 -		106
	SERVICE RETURN		- %		- %	
	SELL PRICES					

FIG. 1—Percentage method of handling incidental and direct job costs for average size projects is shown at bottom of this bid summary sheet. Note incidentals, insurance and inspection listed as separate costs, with insurance in material column.

THE previous article (May EC&M, pg. 70), "Incidental Labor & Direct Job Expense—Part I," was chiefly concerned in making provisions for including all such costs in the estimate. Here, methods of presenting and substantiating such costs will be supplied.

Application of separate markups for labor and material, in the examples given, may appear revolutionary to the reader who has followed the traditional custom of using a common markup. However, *it is the only method that will consistently provide accurate costs.* The subject of separate markups will not be treated here, but for the reader who wishes to pursue it further, we refer him to the book *Electrical Estimating*, published by the McGraw-Hill Book Company.

Fig. 1 illustrates what is known as the *percentage markup* for Direct Job Expenses. *It is in reality a combination of individual items (inspection and insurance) and percentages.* Assuming that the percentages used are basic, the method is very good for the mine-run of small jobs, and medium sized jobs (up to approximately $10,000) which have no special expenses such as hoisting, job buildings, time keeper, and similar special requirements.

"Incidental expenses" may be included with each system (Distribution Panels, Feeders, etc.) or on the summary sheet as shown by Fig. 1. Naturally, the percentage varies with the extent to which minor items of cost have been listed on the estimating sheets.

Insurance, a labor expense, has been listed in the material column, and is subject to a 10% markup for overhead. The reasons for this were given in the previous article.

For "Other Direct Job Costs", Fig. 1 provides 4% and 12% for material and labor, respectively. The breakdown listing for these figures is approximately as shown in Table I.

List Job Expenses

Fig. 2 shows an estimating sheet with a listing of direct job expenses. The data at the top of the sheet, giving the estimated man-days, men required, and duration, serves as a guide for estimating costs for time keeper, telephone, and bills for electricity.

The listing embraces several items of expense not required for the type of project depicted by Fig. 1. Job office and shop buildings, wiring job buildings, and utility bills, are special. Such items cannot be set up as a percentage of labor nor material. Their costs must be lump sums estimated for the particular job.

The total estimated costs shown in Fig. 2 are transferred to a bid sheet as shown by Fig. 3. An additional item of direct job expense—insurance and benefit fund—was not figured until the labor listed in Fig. 2 was added to the other estimated labor. This item could be included with other job costs if the estimator elects. The important thing is to have a *consistent practice* so it will not be overlooked.

Among estimators are three items of expense known as the "Three I's". They are Incidentals, Inspection, and Insurances. These are standard items in most localities and it is well to have a uniform method of listing and checking them.

Substantiate Charges

Regardless of how Direct Job Expenses are figured, the contractor must always stand ready to substantiate his figures. In lump sum bidding a con-

(*Continued on page 158*)

DIRECT JOB COST PERCENTAGE BREAKDOWN

	MATERIAL	LA
ESTIMATING	1.15	1.2
ENG. & DRAFTING (INCL. FIELD ENG.)	0.80	2.8
BLUE PRINTING	—	0.1
SUPERVISION	—	2.6
TOOLS - CONSUMED & DEPRECIATED	—	3.5
SELECTING MATERIALS & EXPEDITING DEL.	1.40	—
CARTAGE & SPECIAL DELIVERIES	0.20	0.2
INTEREST ON PAYROLL	—	0.5
PRORATA CHARGES	—	0.0
TRAV. EXP., JOB, STATIONERY & MISCL.	0.45	0.4
RESERVE FOR CONTINGENCIES & GUARANTEE	0.10	0.1
TOTALS	4.10	11.1

TABLE I—Breakdown of percentages applied for "other direct job costs" used in small and medium sized jobs.

PRICING SHEET — DATE NOV 10 1950

JOB OR BLDG MAXWELL CENTER BLDG — LOCATION

ARCHT OR ENG'R — ADDRESS SEE T-1

PLANS MARKED — SCALE — SPEC. No. — EST. No.

EST BY A.H — PRICED BY — EXTENSIONS BY — CHECKED BY — B.O. No. — SHEET No. 16

MATERIAL	QUANTITY	MATERIAL UNIT	MATERIAL EXTENSION	LABOR UNIT	LABOR EXTENSION
~ INCIDENTAL & DIRECT JOB COSTS ~					
APPROX 720 MAN DAYS 6 MEN (AV.) 24 WKS. SEE PRELIM. LISTING					
ENG & DRAFTING			525 -		
BLUE PRINTING			50 -		
SUPERVISION (INCL. IN LAB. UNITS)					
TOOLS — CONSUMED & DEPR (3% OF LAB.)			450 -		
CARTAGE			100 -		
HOISTING — ALLOW FOR SPCL. CHARGES			250 -		
JOB OFFICE & SHOP BLDGS — DEPR			125 -		325 -
WIRING — JOB BLDGS.			50 -		150 -
ELECT — EST. BILLS			60 -		
TEL. — 6 MO. AT $10.00			60 -		
WATCHMAN — BY G.C.					
TIMEKEEPER & UTIL. MAN.	WKS - 20	70	1400 -		
ALLOW FOR PRO RATA CHARGES			150 -		
TRAVEL EXP (RR & OFFICE TO JOB)			180 -		
INSPECTION LT: 130 CTS PR 1200 UNITS; 555 W OUT 120 MEG.			175 -		
INTR. ON PAYROLL (1%)			150 -		
INCIDENTALS & RES FOR CONTING & GUAR APPROX 25% MAT, 4% LAB			550 -		600 -
TOTALS			4275 -		1075 -

FIG. 2—Detailed listing is used to determine incidental and direct job costs on large projects where special requirements (job office, watchman, etc.) preclude use of percentage method. Total costs are then added to bid summary sheet.

PRICING SHEET — DATE NOV 10 1950

JOB OR BLDG MAXWELL CENTER — LOCATION 1220 SO PIERS ST

ARCHT OR ENG'R MEYER & BOWEN — ADDRESS 420 W ARLINGTON

PLANS MARKED DO — ADDRESS DO

EST BY A.H — PRICED BY — EXTENSIONS BY — CHECKED BY — B.O. No. — SHEET No. 17

SHEET NO.	MATERIAL	QUANTITY	MATERIAL UNIT	MATERIAL EXTENSION	LABOR UNIT	LABOR EXTENSION
	~ BID SHEET ~					
15	SUMMARY — SEE 15			21450 -		15200 -
16	INCIDENTAL & DIR. JOB COSTS - SEE 16			4275 -		1075 -
				25725 -		16275 -
	INS. & BENEFIT FUND (10% OF LAB.)			1628 -		
				27353 -		16275 -
	OVERHEAD & ADMIN. EXP.		6%	1641 -	21%	3418 -
				28994 -		19693 -
	SERVICE RETURN		- %		- %	
	SELL PRICES					

FIG. 3—Bid summary sheet has incidental and direct job cost figures, developed in Fig. 2, added to total material and labor cost of estimate. Insurance (in material column for low mark-up) is added to total before overhead is applied.

ANALYSIS OF CONTRACTORS LABOR COSTS FOR JOURNEYMEN ELECTRICIANS

ST OF ITEMS TO BE ADDED TO A $2.50 HOURLY WAGE SCALE - SEE NOTES
D ON AN ANNUAL VOL (COST) OF $300,000.00 WITH A "60/40" MAT.-LAB. RATIO

DIRECT LABOR EXPENSE

ENT OF ROLL		COST PER HOUR
0	I & E W BENEFIT FUND (ELECT. INS. FOUNDATION)	0.0750
0	ASSOCIATION DUES	0.0250
0	STATE UNEMPLOYMENT CONTRIBUTION	0.0700
0	FEDERAL UNEMPLOYMENT CONTRIBUTION	0.0075
0	FEDERAL OLD AGE SOCIAL SECURITY	0.0250
0	WORKMAN'S COMPENSATION INSURANCE	0.0625
0	PUBLIC LIABILITY, PROPERTY DAMAGE, OCCUPTNL DISEASE, ETC	0.0375
0	ESTIMATING AND ENGINEERING	0.0750
0	TOOLS AND CONSTR. EQUIPMENT (CONSUMED & DEPR.)	0.0750
0		0.4525

OVERHEAD EXPENSE — SEE NOTE 4

ENT OF ROLL		COST PER HOUR
0	RENTS — OFFICE & STORE ROOM (INCLUDING LT & HEAT)	0.050
0	POSTAGE, FURNITURE, TELEPHONE, AND STATIONERY	0.050
0	TAXES, LICENSES, LEGAL, AND MISCEL. EXPENSES	0.025
0	SALARIES FOR OFFICE EMPLOYEES (INCL. STORE RM. ATTENDANT)	0.175
0	TRAVEL AND SALES EXPENSES (AUTO, R.R., HOTEL ETC.)	0.050
0	ADMINISTRATIVE SALARIES	0.200
0	ADJUSTMENT FACTOR (3 BAD YEARS IN 10)	0.025
0		0.575
	ASE PAY — CLASS "A" JOURNEYMEN ELECTRICIANS	2.50
	RECT LABOR EXPENSE — 18 %	0.45
	VERHEAD EXPENSE — 23 %	0.575
	STIMATED NET LABOR COST PER HR.	3.525

S

DETERMINE COSTS FOR APPRS., FOREMEN & SUPTS., ADD 41% TO WAGE
ALE PAID

PERVISION, CARTAGE, & SPCL. DEL. COSTS, TO BE ADDED AS DIR. JOB EXP.

R INSTLN.-ONLY (MATERIAL BY OTHERS) PROJECTS, ADD 45% TO DIR. JOB EXP
D 5% TO OVERHEAD

RCENTAGES OF COSTS VARY ACCORDING TO TYPE OF JOB AND THE INDIVIDUAL
NTRACTORS EXPERIENCE

O ALLOWANCE HAS BEEN MADE IN THE ABOVE TABLES FOR SERVICE
TURN (ANTICIPATED PROFIT).

TABLE II—Contractors' labor cost analysis showing development of percentages to be added to hourly wage rate when billing labor.

CONTRACTORS COST (APPROXIMATELY) PER HOUR FOR SUPPLYING THE SERVICES OF A CLASS "A" JOURNEYMAN ELECTRICIAN RECEIVING $2.35 PER HOUR

(SEE NOTES)

SIZE OF PROJECT (IN MAN DAYS)	LABOR MARKUP FOR JOB COSTS & OVERHEAD			LABOR TOTAL COST PER HOUR	
	JOB COSTS %	OVER-HEAD %	TOTAL %	COMPLETE INSTALLATIONS 60% MATERIAL 40% LABOR	INSTALLATION-ONLY PROJECTS (ADD 5% TO COMPLETE INSTALLATION COST)
5 - 10	20	55	75	4.10	4.30
10 - 20	19.6	45.4	65	3.87	4.08
20 - 40	19.4	38.6	58	3.71	3.90
40 - 60	19.2	35.3	54.5	3.64	3.82
60 - 75	19	33	52	3.57	3.75
75 - 100	18.6	30	48.6	3.49	3.66
100 - 125	18.4	28	46.4	3.44	3.62
125 - 175	18.2	26.3	44.5	3.40	3.57
175 - 200	18	25.2	43.2	3.37	3.54
200 - 250	18	24.5	42.5	3.35	3.52
250 - 300	18	23.5	41.5	3.32	3.49
300 - 400	18	23	41	3.31	3.48
400 - 500	18	22	40	3.29	3.45
500 - 600	18	21	39	3.27	3.43
600 - 800	18	20	38	3.25	3.41
800 - 1000	18	18.5	36.5	3.21	3.37
1000 - 1300	18	17.8	35.8	3.19	3.35
1300 - 1700	18	16.8	34.8	3.17	3.33
1700 - 2200	18	16	34	3.16	3.32
2200 - 3200	18	15.5	33.5	3.14	3.30
3200 - 4400	18	15.2	33.2	3.13	3.28
4400 & ABOVE	18	14.8	32.8	3.12	3.27

NOTES:-

1.- COSTS BASED ON SURVEYS OF REPRESENTATIVE JOBS

2.- PERCENTAGES OF COSTS HAVE TO BE VARIED ACCORDING TO THE INDIVIDUAL CONTRACTOR'S EXPERIENCE AND THE TYPE OF PROJECT BEING ESTIMATED

3.- SUPERVISION TO BE ADDED AS A DIRECT JOB EXPENSE

4.- ABOVE TABLES ARE CONTRACTORS ESTIMATED COSTS - NO ALLOWANCE HAS BEEN MADE FOR RETURN OR PROFIT

TABLE III—Guide for estimating labor costs is this type of table used by some contractors. Percentages to be added to base labor rate vary with size of project in man days.

Where's Your Break-Even Point?

A discussion of a suggested graphical method of determining the break-even point of an electric motor repair business.

The term "Break-Even Point" can be defined as that point in sales volume at which income just exactly covers the total costs of direct labor, material and overhead with no profit or loss resulting.

During the war years, most businesses experienced a large increase in all types of overhead expenses, but were able to show substantial profits because of a greatly increased volume of sales. As we all know from sad experience, overhead costs are much more easily increased than reduced. There was a great deal of justified concern that in the postwar period overhead costs could not be reduced in line with the expected decrease in volume.

Declining Sales

While sales volume did not fall off in the postwar period anywhere near as much as had been feared, many businesses did actually fail because they were not able to reduce costs in line with declining sales. Their "break-even" points during the war period had been so high that even a mild decrease in sales had turned reasonable operating profits into consistent losses.

We are now in a period during which a substantial volume of sales can be expected, assuming that we continue a reasonable amount of advertising and sales effort, and that we continue to perform high quality work and good service at fair prices. All items of cost, however, have radically increased in the past six months. With heavy increases in tax rates already with us and more to be expected, it is essential that we operate well above our break-even points. This must be done to obtain a reasonable return on our investments after taxes and to be prepared for a future decrease in volume whenever it may occur.

A continual awareness of the major items of cost in our individual businesses and their up and down movement with changes in sales volume and types of sales undertaken can be extremely valuable. This paper will present a simple graphical method of tabulating this important information which lends itself to easy analysis of our individual business operations. The following discussion will emphasize the method presenting operating figures, rather than the specific figures used.

To prepare the sample charts which illustrate this graphical method of determining "break-even" points, it was necessary to employ actual figures which were applicable to our motor repair industry. Those figures used were taken from Selden High's NISA Sales Survey Report for 1949 presented at the NISA Convention in Boston in June, 1950. Data from the 1950 survey were not yet compiled at the time this paper was written.

Three different sets of figures were used: 1) overall industry figures; 2) a business with an annual volume of about $50,000; 3) a business with an annual volume over $200,000.

Overall Industry Figures

Chart I was developed from the following overall industry figures for 1949 as revealed in the Sales Survey Report:

Cost Item	*Percent of Sales*
Direct Labor	28.8
Material	37.8
Total Overhead	29.1
Total Cost	95.7
Net Profit before taxes	4.3

To present this picture graphically, a sales or income line is drawn from zero to 100% of sales, against which the various items of cost may be compared for varying sales volumes.

A straight line is plotted at 29.1% of sales to represent total overhead costs. For complete accuracy, this line would increase slightly with increased sales volume since some overhead costs such as payroll, taxes, electricity, gas and telephone, trucking expense and compensation insurance will vary with sales volume. As we all know only too well, however, the major overhead items such as rent, taxes, depreciation, insurance, administrative, office and supervisory salaries, selling expense, etc. remain comparatively fixed regardless of sales.

A line to represent direct labor cost is drawn on top of the overhead cost line, ranging from zero labor cost at zero sales to 28.8% of sales at 100% sales (57.9 on vertical axis).

Graphic Costs

A line for material cost is then drawn on top of the labor cost line, ranging from zero material cost at zero sales to 37.8% of sales at 100% sales (95.7 on vertical axis).

This top line now represents total costs which, at 100% sales, are: overhead 29.1%, labor 28.8%, material 37.8%, total cost 95.7%.

Total costs at any sales volume can now be read directly from this top line, illustrating in a graphic manner how labor and material costs will vary with sales volume but how overhead costs remain constant.

The break-even point, where the total cost line crosses the sales or income line, is at 87.0% of sales. Thus if sales volume were to drop off 13.0%, all profit would be wiped out.

Conversely, note that if sales volume could be increased 10% to 110%, total cost would be 102% and net profit would go to 7.3% of total sales instead of the 4.3% reported by our industry for 1949.

A similar chart made up from the actual operating figures of your own business will illustrate in a startling fashion the importance of every effort you can make to keep your break-even point well below your sales volume. Profits will increase in dollars and in percent of sales in a dramatic manner the further beyond your break-even point your volume can be pushed as long as your overhead remains constant and labor and material costs maintain the same percentage.

To further illustrate the method of graphical presentation of your own operating figures, Charts II and III

* From a paper presented at the 18th Annual NISA Convention at San Antonio, Texas.

By William M. Hogue*
Larsen-Hogue Electric Co.
Los Angeles, California

have been made up on actual monthly dollar figures.

The figures used are again taken from Selden High's Report for 1949 in which he broke down the operating figures on the basis of size of business reporting.

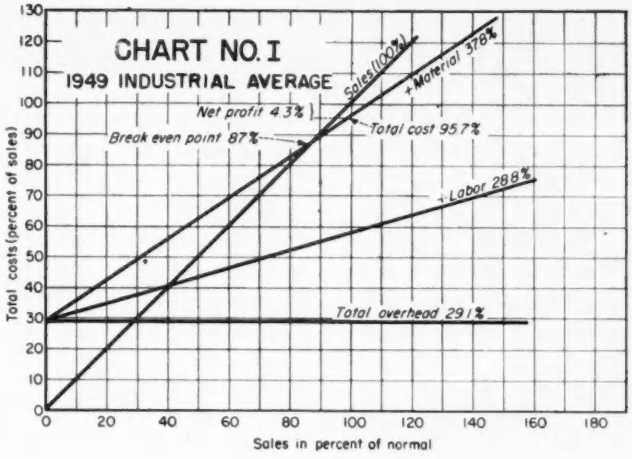
Chart No. II is developed from figures reported by the group doing a volume of approximately $50,000.00 a year or $4,000.00 per month with costs as follows:

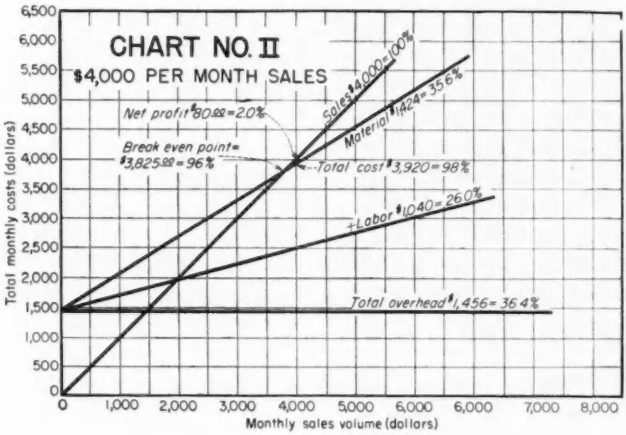
Cost Item	*Percent of Sales*	*Monthly Cost in Dollars*
Direct Labor	26.0	$1,040.00
Material	35.6	1,424.00
Total Overhead	36.4	1,456.00
Total Cost	98.0	$3,920.00
Net Profit before taxes	2.0	$ 80.00

Note that this small shop is operating very close to its break-even point (96.0%) that the profit on sales of 2.0% is low and that a small drop in volume would quickly turn the small profit into a substantial loss.

Chart No. III is based on figures reported for the group with sales volumes of over $200,000.00 per year and is made up on the basis of a monthly volume of $20,000.00 with costs as follows:

[*Continued on page* 159]





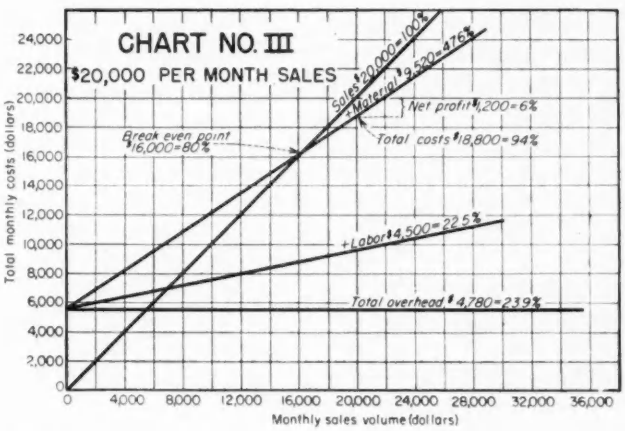
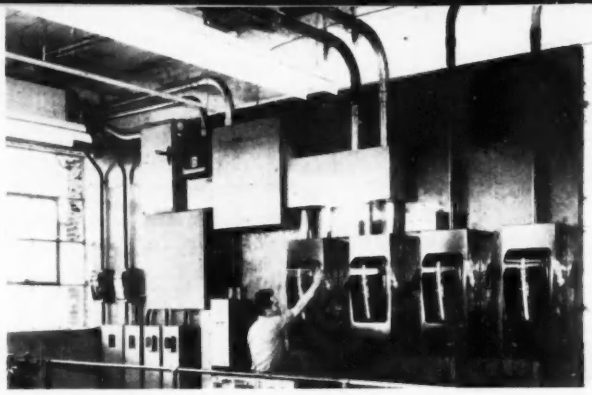


CHART I—Break-even point for average electric motor service shop (based on 1949 Sales Survey Data) was at 87 percent of normal sales as determined by graphic method. Note small net profit before taxes of 4.3 percent of sales.

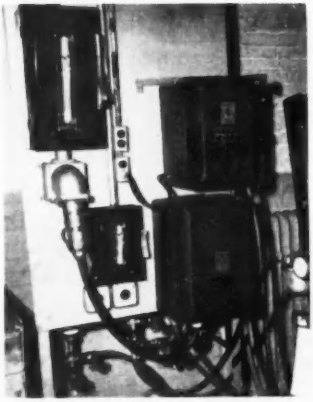
CHART II—Graphic picture of a motor service shop business doing a $4,000 per month volume. Chart is developed on basis of monthly cost and sales volume. Careful analysis of graph can guide owner on taking proper action to improve profit status of the business.

CHART III—Similar graph plotted for a business doing a monthly volume of $20,000. A lower break-even point plus higher sales volume gives better profit picture. Try this method with your own business figures to determine your break-even point.

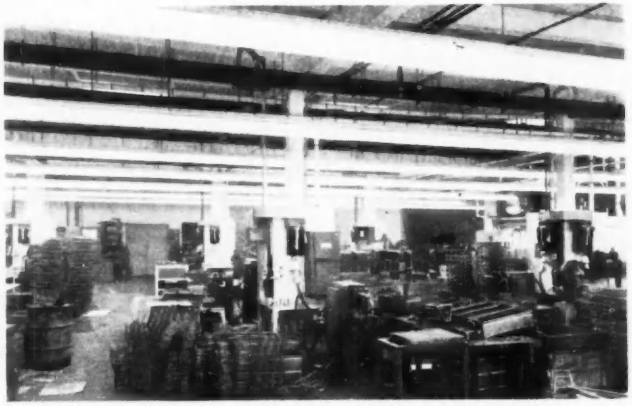
SELF-SERVICE distribution center constructed around structural column has one 440-, two 220- and four 110-volt plug-in outlets on each panel.



MAIN SWITCHBOARD is equipped with vacu-break feeder disconnects and illuminating ground-leakage indicator that flash when grounded equipment is placed in operation. Location of faulty equipment is fast and positive by matching flashes with operation cycles.



SINGLE-PANEL power boards located along walls and between windows of shop carry multi-voltage plug-in facilities for welders, motors and electronic timers.



SHIFTING POWER requirements are served by plug-in panelboards fed from overhead busducts carrying various voltages through the shop. Illumination from Holdenline plastic-sided slimline fixtures maintains 40-footcandle level on all working surfaces.

Self-Service Distribution

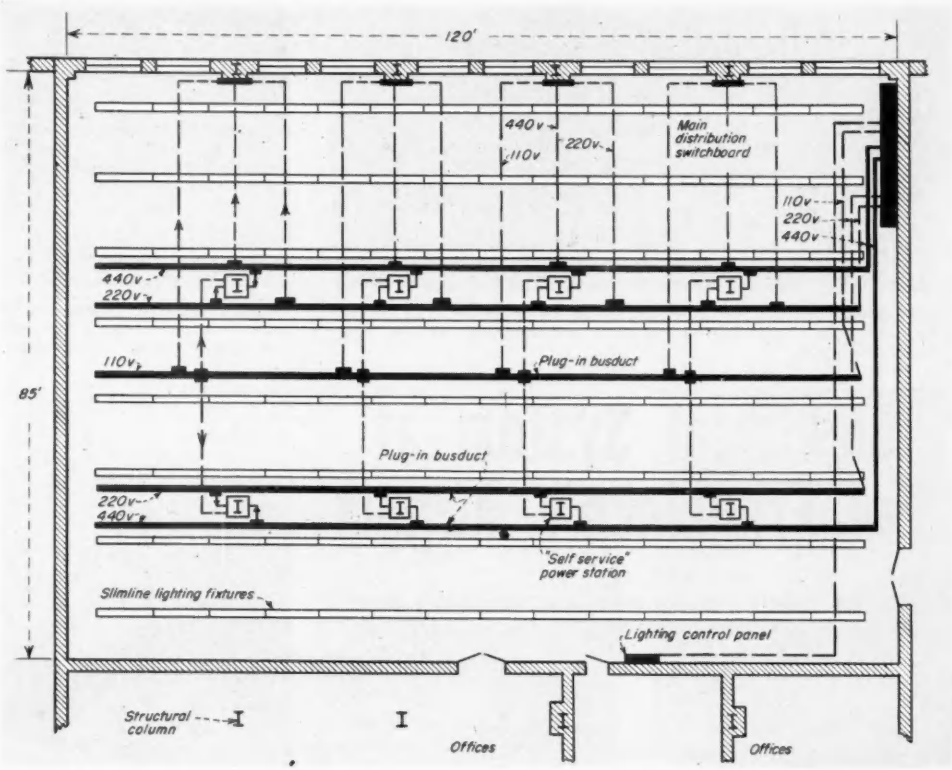
Power centers with multiple plug-in facilities for supplying 440-, 220- and 110-volt current, installed by the Service Electric Company of Cleveland, make it possible to quickly shift and reconnect equipment for changing production requirements.

By C. H. Ashbaugh

Chief Engineer
Mid-West Metallic Products, Inc.
Cleveland, Ohio

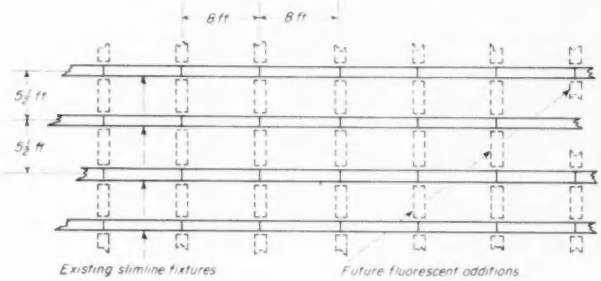
INSURANCE against shorts, outages and power failures; flexibility to permit quick, safe changes in production set-ups and machinery arrangements; 110-, 220- and 440-volt service throughout the shop, and an electrical framework that will support normal expansion for several years to come were the objectives of the electrical system design for Mid-West Metallic Products' plant when expanding manufacturing demands dictated a move to larger quarters.

The company's activities in the welded wire products field necessitated frequent rearrangement of welding-, cutting- and forming equipment to maintain efficient straight-line production under varying fabrication demands. Since equipment includes 220-volt 3-phase machines, 440-volt single-phase welders and 110-volt electronic timers, such production rearrangements resulted in major shifts of electrical loads and voltage requirements. Only with a sturdy, flexible system could these objectives be obtained. And, with the various production activities calling for clear vision, it was also mandatory to consider a lighting installation that would provide general high-level low-glare illumination throughout the plant.



PLUG-IN BUSDUCTS carry power through the shop; 440- and 220-volts along each column line, 110-volts through the center of the factory. Tapped branches extend along ceiling line, then down to multi-voltage self-service power stations located around columns and between windows.

LIGHTING installation in machine shop provides for stepping up light levels to approximately 100 footcandles by the addition of 2-lamp 40-watt fluorescent units between the now-installed continuous runs of 8-foot slimline units. Present intensity is 55 ft.



As finally designed and installed, the power and lighting plan represents the thinking of the Mid-West, Service Electric, Cleveland Electric Illuminating, and Holdenline companies.

Most unique is a group of self-service distribution centers; each center containing a 440-volt plug-in receptacle, two 220-volt receptacles and four 110-volt outlets. In addition, each station includes connections for compressed air and refrigerated water, so that all combinations of service are available at all stations. Single self-service centers are positioned intermittently along shop walls and between windows, while 2-and 4-panel stations are constructed around eight of the structural columns, providing service for equipment located in the center of the open floor areas. Each 4-panel station forms a hollow square around a column and contains four 440-, eight 220- and eight 110-volt outlets; more than enough to accommodate any possible concentration of equipment.

All 440- and 220-volt plugs are controlled by vacu-break safety switches, permitting the disconnection of individual machines for maintenance, repair or adjustment without disturbing the operation of other equipment.

Power is distributed through the plant by five plug-in busducts, supported 2-feet beneath roof beams by strap hangers and duct brackets.

Since load centers are predominantly located along column lines, one 225-

(*Continued on page 162*)

HOLE DIGGER installed on truck made easy the job of digging 454 holes each deep enough for a steel base for transformer and runway marker light at San Francisco's Airport.

SIMPLE WOODEN FRAME provided guide for laborer to cut out ground at each hole for seating a metal form.

Electrical System at San Francisco's Airport

Electrical contractor uses labor and time-saving ideas for quick installation of runway lights, controls, and electrical system for California Airport in record time.

By Wm. A. Cyr

MANNING and Whittaker, San Francisco electrical contractors, recently completed in record time the installation of 399 runway marker lights on over six miles of landing strips at the San Francisco Airport. Also included were 54 test receptacles and 102 units with blue lenses for taxiway lighting, requiring the excavation of a total of 454 holes.

This represents what is believed to be the largest installation of runway lighting for any airport in the country, as all four of the San Francisco Airport runways are lighted. The longest runway is 8,900 feet long, another is 8,700 feet, the third is 7,400 feet, and the shortest is 6,800 feet.

The installation required the laying of over 130,000 feet of cable in the primary series circuits for the marker lights, installation of the bases for these units, and 14,000 feet of control cables. A test receptacle was set every 1500 feet along the runways for protection and isolation of the circuits. It also included terminating the controls in a lighting control building, installation of an emergency plant for cases of power failure, pumps to drain the field, substations and a wind tee.

The runway marker lights were of the Crouse-Hinds fixed focus bidirectional high intensity type, constructed in accordance with CAA Specification L-819. They project two main beams of light up and down the runway, and use a 200-watt, 6.6 amp., T-14 75-hour life lamp. Top and side light is provided by three prismatic glass panels. Each unit is provided with a breakable coupling, designed to withstand static loads from high winds or propeller blasts, but which will break when struck horizontally with a light impact—a safety feature in case struck by a plane in landing or taking off.

The wind tee is of the automatic type, with operator control and position transmitter, no-wind return, and both red and green lights. It was also furnished by Crouse-Hinds Co.

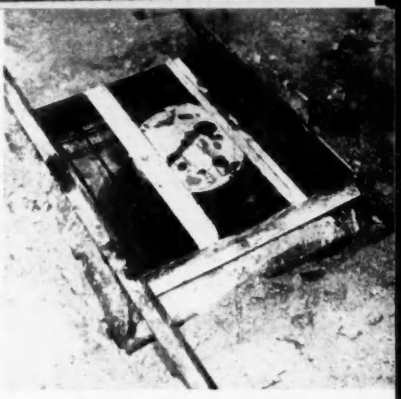
Electrical contractor Don Manning developed a number of labor-and-time-saving ideas for quick installation of the equipment, which was instrumental in enabling his firm to have the low bid on this job. Through the use of these ideas, illustrated in the photos, from 12 to 15 marker light bases were set per day, which permitted the job to be completed in record time.

SECOND OPERATION in wiring job was ditching for laying of cable between preset marker bases. Combination ditcher and back filler was used for trenching.

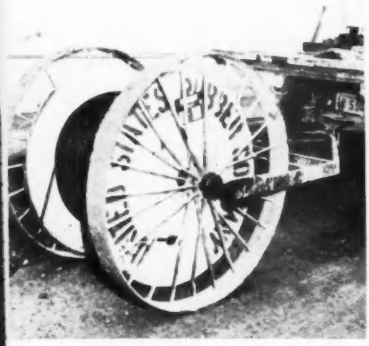
TEST FOR GROUND is made before the trench is back filled permanently, after cable has been cut and prepared for insertion through bushings and conduit into base.

TWENTY FORMS, made of anodized steel welded as shown, cut installation time to one-fifth, contractor estimates.

UNIT COMPONENTS include steel case for base, steel bar reinforcing rods for concrete top, and steel form.



STEEL FORM and unit assembly in place at hole, ready for the concrete mix. Heavy spikes hold the form rigidly.



CABLE was reeled out from cable rig pulled by truck. Axle extends through both the wheels and cable reel, which is suspended to turn freely.

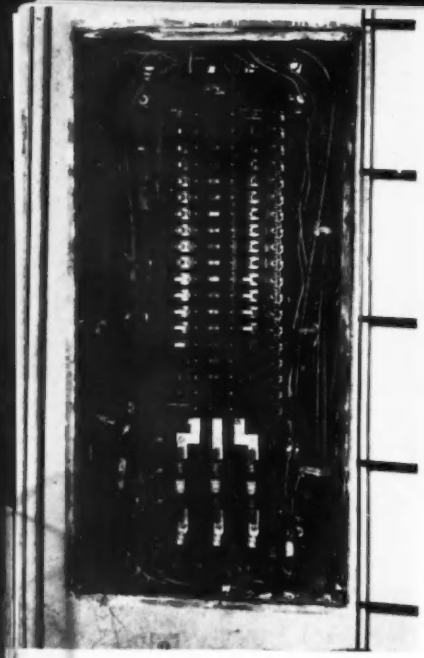
BACKFILL was sifted through screen mounted on rubber-tired wheels, to remove rocks which might later damage cable.

COVER PLATE is removed from the base by electrician so that the cable may be fed into the base and prepared for installation of transformer.

SERIES TRANSFORMER and control cables are installed by a third crew. Cover is removed, metal container sponged to remove condensation. Transformer connections are made.

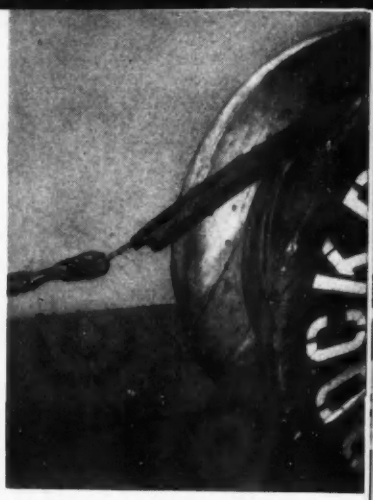
MARKER LIGHT is finally installed on a breakable coupling on top of the base cover. Unit later gets a lamp and lenses to complete the installation. Leveling and sighting devices aid adjustments.

UNIT SUBSTATION which serves a bank of pumps is installed at edge of field. Floodlights are used to locate this obstacle for the information of pilots in incoming planes.



DISTRIBUTION PANEL for a typical floor of the G. Fox & Co. department store, Hartford, Conn., shows new Type AVC Rockbestos cable pulled in place and connected after removing old Type R cable of original installation.

PULLING GRIP shown here was slipped over end of cable assembly to aid in pulling it into conduit.



CABLES were factory assembled as a unit for each conduit run. This one is all ready to pull into old conduit riser.

REWIRING FOR

Department store doubles wiring capacity at minimum

RECENTLY when officials of G. Fox & Company, Hartford, Conn. department store, decided to do a major relighting job, they learned that their building was suffering from a malady akin to "hardening of the arteries". The electrical wiring system was loaded to capacity, and beyond. Their electrical contractor, H. H. Mandley of Hartford, told them a modern lighting system could not be installed until the old electrical system was changed—replaced with a modern and safe installation of considerably greater capacity.

The big problem was how to change over from the old system to a modern one with adequate wiring capacity, with the minimum disruption to normal store activities, and economically. After study of this problem by Mandley, store officials, and a representative of the Rockbestos Corporation called in by Mandley, a practical and economical solution was devised.

First, it was decided that the cost of ripping out the old conduit system and replacing it with new and larger conduits and cables, would be prohibitive. The old conduit system had been embedded in the building structure when the store was originally built. Installation of new and larger conduits would also have required installation of new and larger distribution panels. These were also embedded in the building walls.

Second, substitution of the old Type R cables originally installed by modern fireproof NEC Type AVA (Rockbestos Type AVC) cable, was analyzed. This proved to be both practical and economical. The inherent ability of Type AVA cable to operate safely at higher temperatures would permit heavier current loads than would be possible with other types of insulation.

Further, the Type AVA cable is designed to resist heat—it won't burn, get hard or brittle, or crack or flow even when subjected to continuous high temperatures. Its seamless impregnated asbestos braid is tough, resilient, flexible, and resists abrasion. These qualities, plus its ability to carry a greater load with the same size cable, provides more years of useful life, and saves costs in installation.

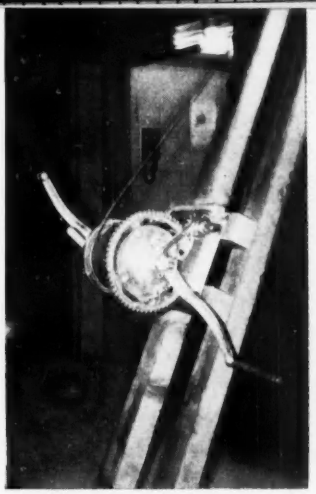
It was determined that three 500 MCM cables, and two No. 2/0 cables for the neutral, could be pulled into the existing conduits. Thus no new conduits nor distribution panels would be required to replace the old ones. The Type R cables in use had a maximum current capacity of 320 amperes per phase; with Type RH, the current of 380 amperes per phase; and with Type AVA, the current capacity would be 470 amperes per phase. Based on this analysis, it was decided to utilize the Type AVA (specifically, Rockbestos "High I") cable.

The installation was carried out on week-ends, with no interruptions to the normal selling hours of the store. Close cooperation between the electrical contractor and Rockbestos company made this possible. Mandley worked out a schedule, splitting the job up into sections. Each section was of such size that would allow him enough time to pull out the old cables, pull in the new,

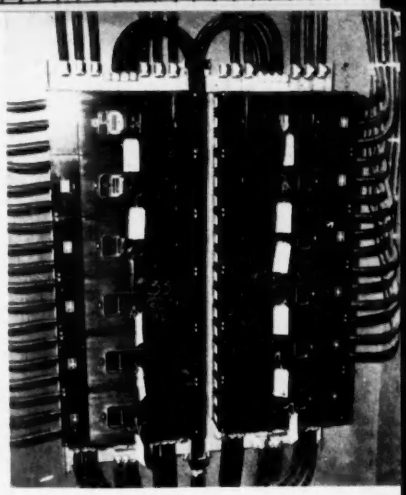
Editor's Note

The particular type of project described in this article is currently under mobilization control limitations. However, the techniques and data pertain to conservation of critical materials or manpower and are equally applicable to other types of projects.

PULLING WIRE is fed out of conduit to winch by workmen during pulling operation.



HAND WINCH was used to obtain steady pull and powerful traction on cables being pulled into old conduit.



POWER DISTRIBUTION panel, located in basement, shows new Type AVC cable installed and connected.

ADDED CAPACITY

By Berlon C. Cooper

cost, by installing new Type AVA asbestos varnished cambric cable in old conduit system.

and reconnect all circuits in that section over a week end.

Mandley furnished Rockbestos with exact dimensions and sizes of cables for each conduit run. These were insulated, cut to exact length, and assembled onto one reel as a unit at the factory. This made it possible for Mandley to hook a cable grip over the end of the cable unit and pull all of the cables into a conduit at one time. Cables were usually pulled from a higher to a lower floor in order that the weight of the cables might assist the pulling operation.

The entire job was carried out in this manner over a total period of about two months. Each week end, Mr. Mandley took over, finished up a section and had everything ready to function at the store's usual opening time on Monday morning. The complete change-over from the old installation with Type R cables to the new installation with Type AVA cables nearly doubled the wiring capacity, increasing it from about 4.5 to about 7.0 volt amperes per square foot of selling area. Use of Type AVA cable increased capacity by approximately 50% over what would have resulted through the use of Type R cable, Mandley estimates, and at an approximate saving of 50% on the cost of the job.

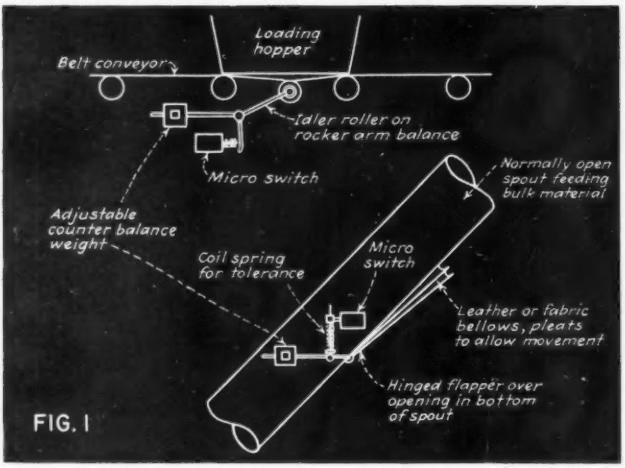
The G. Fox store structure was built in 1917, just 34 years ago. The original wiring system was a then modern installation, representing a forward step in electrical progress. It was designed to serve two banks of electric elevators, a new system of electric lighting (gas lighting was still in use in homes and for street lighting), miscellaneous motor loads, etc., and what was then considered ample with additional capacity for the future growth of store.

The phenomenal growth in electrical utilization devices, equipment, and use resulted in this rapid impact on the "1917 adequate wiring system" in the G. Fox store. The officials, being progressive, eventually installed escalators to supplement the original elevators and speed traffic on the lower floors of their nine-story building. Then the entire store was relighted during the 1930s, with a modern semi-recessed Holophane lens system, forerunner of this type of lighting which later became so popular before the advent of fluorescent lighting, being installed on the entire first floor. Then the old elevators were replaced. Power was next needed for a modern air conditioning system, and to serve an electric kitchen as part of a school for cooking. Thus, when it was decided to relight the store again recently, technological progress in other fields had already laid claim to all available capacity of the old wiring system.

While the rewiring involved here relates to a commercial building, the same problem exists in thousands of industrial plants. Solution to this problem offers genuine conservation of materials and manpower which are applicable and important in the rewiring of plants for expanded use of electric power for greater defense production.

By Thos. R. Hughes

Electrical Safety Engineer


Loading hopper
Belt conveyor
Idler roller on rocker arm balance
Micro switch
Normally open spout feeding bulk material
Adjustable counter balance weight
Coil spring for tolerance
Micro switch
Leather or fabric bellows, pleats to allow movement
Hinged flapper over opening in bottom of spout
FIG. 1

Remote Control

Circuit considerations for safety when two

THIS is the concluding article of a series on industrial control circuits. The first one covered some precautions in wiring for manual operation of remote control. The second one brought out features to be considered in applying automatic devices to remote control circuits.

In those articles, we were primarily concerned with a single controller and its auxiliary circuits but in this article we shall discuss the interconnection of control circuits from several contactors or controllers which handle the operation of different and varied equipment.

The first and simplest example is the case where all the equipment can run at the same time and is not harmed by lack of material or loss of work load. Citrus packing houses, for instance, have a long string of conveyors, washers, dryers, polishers, and sorting mechanisms, which may run continually, whether they are loaded or not. In their case, the motors are all small, cross-the-line-start induction types.

One large controller is used to start and stop the whole bank of motors but this controller must have a horsepower rating equivalent to the combined horsepower ratings of the motors it controls. The motor leads from this controller are passed around the series the same way a feeder circuit is handled for a group of loads. The motor supply leads for each motor are tapped from these feeders through an individual fused disconnect switch or circuit breaker near the motor. Two of the phases are then fed through the thermal heaters of a running-overcurrent relay, mounted in a small cut-out box, at each motor.

Contacts in Series

The overcurrent trip contacts of these relays, for all the motors, are connected in a series loop and inserted in the stop-button circuit of the controller, so that the tripping of any one relay opens the controller hold-in coil supply and stops the entire bank of motors. This the the simplest and most foolproof system that can be used but there is always the remote chance of a short circuit at an individual motor blowing one or more fuses in its branch switch or tripping open its circuit breaker. In this case, the other motors would continue to run but little damage would be done because the whole operation is under close observation of several people.

Where real damage could be done if any motor stopped without tripping the control circuit, or where the equipment runs without workers stationed around it, a means of opening the control circuit and dropping out the controller would have to be provided.

At critical points, for instance, material could pass over simple balance mechanisms which would trip limit switches or Micro switches if their loading increased above normal. Two examples of such mechanisms are illustrated in Fig. 1 and located at positions A, B, and C in Fig 2.

Limit switches can protect against over-shooting of boxes or material from conveyors. The side or top of a container can be hinged (bellows fashion) to trip a switch if it is being filled beyond capacity. There are countless ways of arranging "tell-tale" trips to open if a break occurs in material such as wire, string, or cloth being fed off of rolls.

Where all of the motors are controlled by the one controller, such emergency devices would be connected in the control circuit loop; in series with the running-overcurrent relays.

In the majority of complex operations it is not feasible to use a main controller for starting all motors simultaneously. Some must start and produce a flow of material before it is safe to start others, where machinery would be damaged in running unloaded. Or a mill must be brought up to a high speed before material is fed into it, or a process must reach a given temperature or humidity, etc.

Sequence Starting

Thus the motors must start in a prearranged sequence or perhaps the operation must be shut down in proper sequence. This may be a simple rotation, of one following the other, or an automatically regulated system of time intervals. Fig. 2 gives a crude representation of a string of equipment such as one might find in a grinding operation or mill. We are not implying that such a string of equipment would require a sequence controlling—we are merely using it to demonstrate how automatic sequence control could be applied.

In all sequence starting and stopping of machinery, it is necessary to provide each motor with an individual magnetic starter or controller and these are often grouped in a main control panel which protects from dust and provides ease of interconnection and trouble-shooting. It should be un-

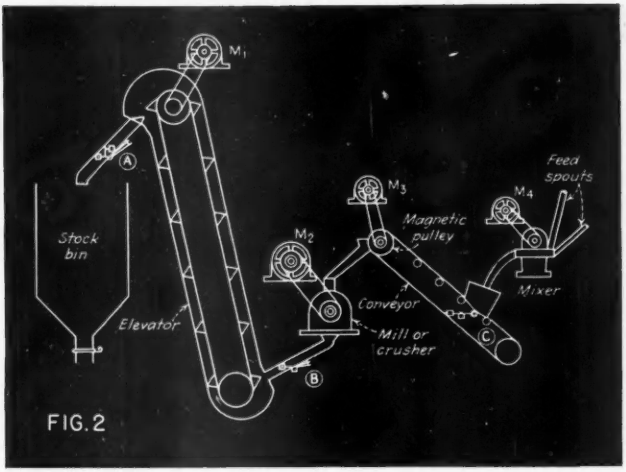


FIG. 2

Circuit Safety

or more controllers are operated together.

necessary to point out that some heat is produced by the devices within this panel and their life will depend on its being placed where proper heat dissipation can result.

Where the motors are all simple induction types with no speed control employed, and operation is continual after the initial sequence of starting, each hold-in coil circuit may be supplied by its original taps from the line terminals of its own contactor. The schematic of such an arrangement is shown in Fig. 3

It is often desirable to be able to start and stop a certain machine of the string separately under manual control, for testing or adjustment. This may be accomplished by means of the usual pushbutton station, as shown at Z, and a double throw switch. The two poles or blades of the switch are indicated at S_1 S_2 in Fig. 3. With the switch thrown to the contacts marked M for manual control, it is apparent that we have the normal control circuit connections for a single magnetic starter or controller.

If no manual control is desired at any time, the pushbutton station is discarded and the control circuit is simplified by a simple loop from point 1 in the schematic of Fig. 3 to point 2, thence through the running-overcurrent relay to 3, through the hold-in coil and on 4. Of course, we have yet to insert the ties between this loop and the corresponding loops of other controllers concerned.

To comply with the requirements of paragraph 4374 of the National Electrical Code and to prevent damage or false starting by short-circuits in neighboring circuits, all interconnections are provided through small auxiliary relays, as shown at X and Y in the schematic of Fig. 3. X furnishes the connecting link from the preceding controller in the string. Its solenoid is inserted in the control circuit loop of the preceding controller and its actuated contacts are inserted in the loop under consideration (5 and 6).

Interconnected Controller

Y is the connecting link to the following controller of the string and its solenoid is inserted in the loop at 7 and 8. When the double throw selector switch is thrown to the A contacts for automatic operation, this controller is interconnected with the other controllers through the relays X and Y. Either X or Y may be incorporated with or fed through a timing mechanism to provide a prearranged delay in the pickup of the following controller or series of controllers.

Now we are ready to apply the various features of such a control hookup to the machines in Fig. 2. In the neighborhood of the spouts feeding the mixer, there is a pushbutton station that is connected to the control circuit of the controller for motor M_1 in the normal manner, except that relay Y is inserted in the hold-in coil circuit for linking the controller of M_2. The start-button gets the elevator running and in turn the solenoid of relay Y actuates its contacts, which are in the control loop of the next controller, and M_2 is also started.

Delayed Timing

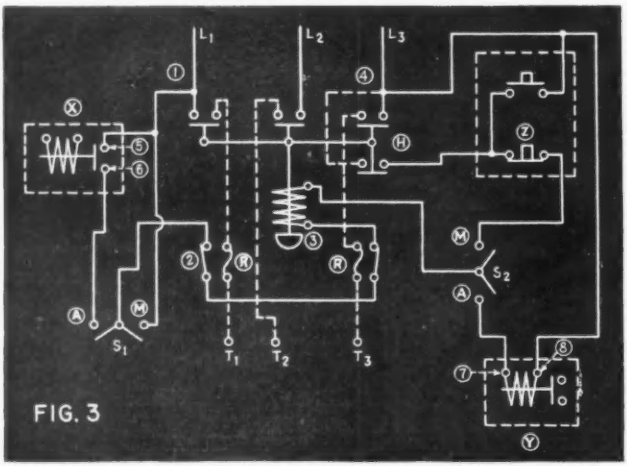
Here there is a variation because the Y relay of M_2 is fed through a delayed timing device before connecting to the controller of M_3, so that the mill can attain full speed before M_3 starts feeding material into it. When M_3 starts, it immediately starts the mixer motor M_4 and material is fed from the spouts.

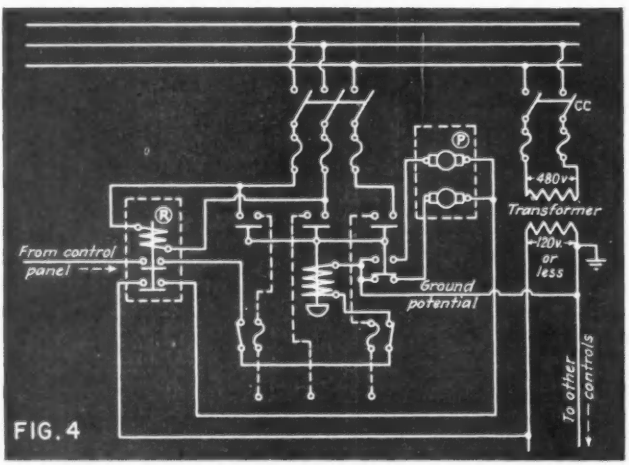
Next let's consider the emergency trips. If the conveyor belt slips or its motor stops without opening its controller, the emergency trip at C will open the controller of M_4 as the hopper fills to excess. The actuated contacts of this tripping device are inserted in the control circuit loop of the controller for M_4. They are of the normally-closed type.

There is an ammeter inserted in a motor lead of the large mill motor. It is a combination of ammeter, actuated contacts, and indicator or register. The actuated contacts are inserted in the control circuit loop of the controller for motor M_3. Thus, if the mill chokes or clogs up and the ampere consumption exceeds a selected value, the actuated contacts will open and stop the conveyor and mixer.

The mill will continue to run unless it is completely clogged and the running-current relay trips. When the attendant resets the contacts, at the ammeter, the conveyor and mixer will resume operation. The emergency trip at B is inserted, likewise, in the control circuit loop of controller for M_3 and this trip will stop the feed of material to the mill but not affect operation of the mill.

The trip at A, however, will immediately shut off the elevator because clogging of the elevator spout would cause the bucket carrier belt to slip and burn at the head pulley. This trip at





X can be so tied in to the system through relays that it will stop M_1, M_2, and M_3; shutting off flow of material but allowing the mill to run and clear itself.

Our final consideration is the sequence of shutting down this string. Flow of material in each spout feeding the mixer is controlled by a shutter or gate. These may be operated manually; by solenoids; or by air or hydraulic cylinders. Next to the start-button, which we started the string with, there is a stop-button. Our problem is to secure a closing of all spouts and the clearing of all material through the machines before the string stops itself.

This may be accomplished by two or more procedures. The cheapest would be to have a set of makeup contacts linked to each spout shutter or gate and inserted in the stop-button circuit so that stopping could not be accomplished till the gates are closed. It may be desirable to have a pilot light for each spout to show whether its gate is opened or closed. A second and more expensive method would be to have relays in the stop-button circuit that would automatically cause the closing of all spouts when the stop-button is pushed.

As the stop-button is pushed, it not only secures closing of the spouts but it sets in motion the timing mechanism of a delayed-action relay. It is the actuated contacts of this relay that are inserted in the hold-in coil circuit of the controller for M_1. The timing is, of course, adjusted so that material will clear through the machines before the M_1 controller is dropped out. As it drops out the following controllers drop out automatically and the whole string simultaneously.

Here again, a timed sequence for stopping could be arranged by addition of timing relays in the interconnection setup. It should also be pointed out that the opening of the running-overcurrent relay in any controller will drop out all following controllers or, to put it more intelligibly, will stop the preceding machines in the material flow. Thus, stopping of the mill (M_2) would automatically stop M_3 and M_4, in Fig. 2.

We have been discussing an interconnection of self-energized hold-in coil loops within individual controllers. We come now to a third method of group operation where the control functions are so diverse and staggered that simple interconnection is out of the question. As an example, some machines may have varied speed control while others run only part of the time or pass through on-and-off cycles. Some may even reverse their motion.

In such a setup, the various operations may be controlled manually by an operator at a central control console, much as an organist controls the functions of a pipe organ. On the other hand, the whole string may be controlled by a mechanical or electronic selector, similar to one controlling the continuous recurring cycles of the animated figures on complex electric signs.

Independent Circuit

The control console or panel will be supplied by a separate connection from the line, with which it will control the hold-in coil of each controller in the string. Usually this control circuit voltage will be reduced to 120 volts or even 24 volts, because of the greater freedom from insulation breakdown in control circuits (with consequent lost time or false control), and because a cheaper and more durable class of pilot lamps and fittings may be used.

Fig. 4 shows how the control circuit may be fed off of the 480 volt line. It must be passed through the fused switch, indicated at CC, or a circuit breaker, to protect the primary of the transformer. This switch must be conspicuously labeled, "Control Circuit Disconnect", for the benefit of one wishing to deenergize the control panel.

The secondary of the transformer must be grounded and one side of all controller hold-in coils should be connected as directly as possible to the

(*Continued on page 160*)

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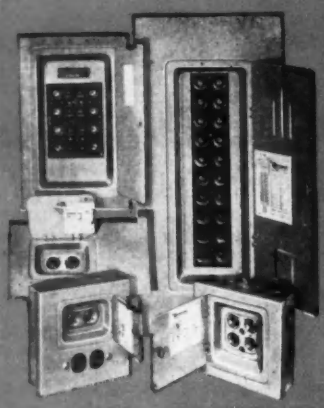

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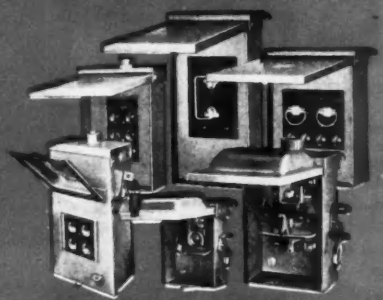

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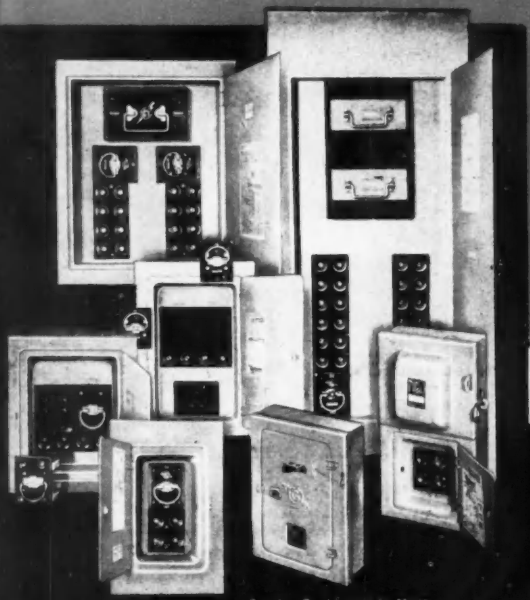

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Main 60 Amp pullout controls up to 12 lighting circuits and range through second 60 Amp pullout.

In Parallel (100 Amp main lugs, 3 wires, 125-250V)

Main 60 Amp pullout controls up to 12 lighting circuits only. Second 60 Amp pullout controls range independently. Both have 60 Amp sub feed lugs.

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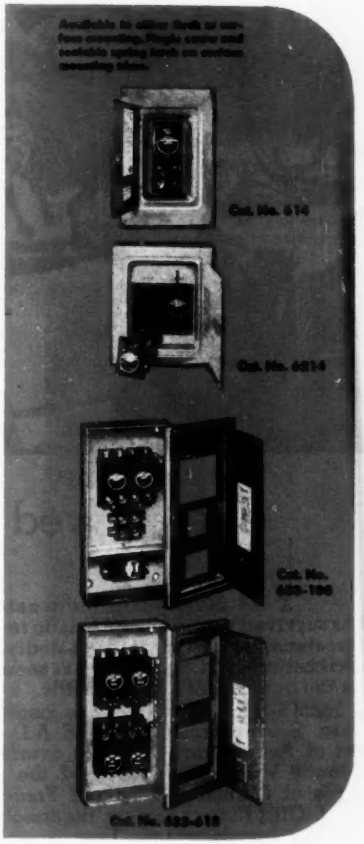

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FOR 2000 years, the western world has survived vast waves of Asiatic invaders who threatened to destroy it. Repeatedly, the fate of civilization and Christianity has seemed to hang on the outcome of a single battle.

Such a decisive action was fought at Augsburg, South Germany, in 955 A.D. Swarming out of Asia, savage Magyars overran the rich Danube Valley. They ravaged the prosperous lands of Germany, Italy and France. At last, under Otto, King of Saxony, the armored Knights of Christendom rallied. They faced a hundred thousand fierce foes. The battle raged all day. Thousands were slain. At last the tide turned and the Magyars fled. For three days the Knights pursued the scattered enemy, killing or capturing thousands more. Symbolic of the west's predominance in weapons and armor of iron and steel, victory was credited to King Otto's iron-tipped Holy Lance.

Augsburg ended the Magyars' attempts to conquer Europe. They settled down to peaceful living in their valley and within 50 years accepted Christianity. Again, history demonstrated the truism that no people or alliance can establish supremacy unless it first predominates in the production and use of iron and steel.

It is reassuring that America produces twice as much steel as the rest of the world combined. America has the steel to win. We will use enough of it to protect our leadership of a free Christian world.

Scrap Metal is Critical Again

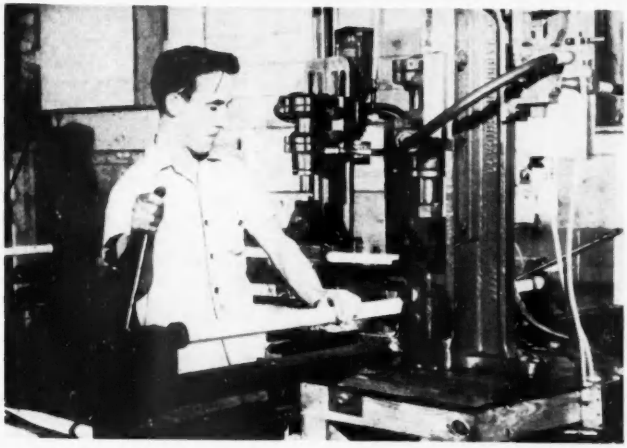
The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment.

Practical Methods



WOODEN HANDLES for garden tools are formed by bonding short dowels together in a hydraulic press equipped with four electric 1000-watt cartridge heaters.

Cartridge Heaters Speed Bonding Operations

EQUIPMENT

The installation of four 1000-watt 230-volt cartridge heaters on a hydraulic bonding machine eliminated several cumbersome clamp-and-jig operations in the Columbus, Ohio, plant of the Union Fork and Hoe Company where garden tools are fabricated with bonded joints.

Confronted with the problems of supplying large numbers of 5-to-6-foot replacement handles, and a scarcity of ash timber used for these parts, the company experimented with fabricated handles formed by several shorter (and formerly wasted) wooden dowels. Using carefully selected short dowels that would match in grain and appearance, splicing cuts were made on the dowels to give maximum strength. The female dowel has a V cut-out and the male dowel a chiseled V on the end. These cuts were covered with a bonding material which, after being placed together, required a curing period of five days at a temperature between 80 to 90 degrees, to give maximum bond and strength of the spliced handle.

To accomplish this, a hydraulic press with a clamp to house the bonded joint was designed and four 1000 watt, 230 volt, No. 170X General Electric cartridge heaters were installed as the heating elements. The heaters were placed as close as possible to the splice, two installed in the lower half, two in the upper half of the clamp. A sensitive thermostat bulb was placed in the lower half or stationary block of the clamp to control the temperature.

The electric controls were so arranged that when the bonded handle was in the proper place and the press actuated, a timing device was started and, at the end of 60 seconds, the press was released. By that time the bonding material was properly set, thoroughly dried, and penetrated into the wood about $\frac{1}{8}$ of an inch. The wood was not scorched and the bonded handles were ready for the curing room with no additional holding clamps required.

At the height of production, 2400 spliced handles are made per day. Bonded handles were tested by a drop test of 125 lb, 14 inches from the splice; and failures have never occurred at the bond.

Aligning Poles With Plumb Bobs

CONSTRUCTION

Normal procedure for aligning street lighting standards is to use two "sighters", two men standing at right angle locations to sight the perpendicular alignment of the pole. A third man adjusts the nuts at the base of the standard according to instructions from the sighters. An experienced crew might do well after some time.

ALIGNING RING is clamped around light standard at about eye level; has metal centering knobs on inside perimeter and automatic fly-cast reels with cylindrical plumb bobs mounted to extension pins on outer rim.

PLUMB BOBS are lowered to base of standard. The four bobs hang at equal distances from side of base when standard is perpendicular. Man aligning poles watches bobs as he turns adjustment nuts at base.

Even at best, this method was too slow for Kuster-Wetzel Electric Company of Long Beach, California. With 5,000 lighting standards to set along some 131 miles of streets at the Lakewood Park housing project, K-W engineers had to devise a less time-consuming way of aligning the poles. The problem was solved by James S. Kuster, project supervisor, who developed a special instrument using the plumb bob principle.

Simple in construction and operation, the device consists of a machined split, Monel metal ring (rectangular in cross-section) which can be clamped around the pole; four automatic fly-cast reels; and a cylindrical plumb bob suspended from each reel. The two halves of the split ring are hinged at one end and have an overlapping joint

NOW! HERE'S THE FIRST IMPROVEMENT IN BX STAPLES IN 25 YEARS . . .

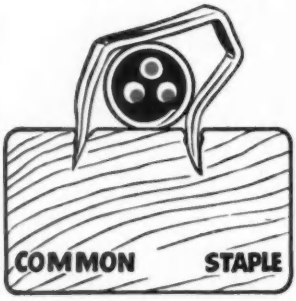
PROVED BY SERVICE

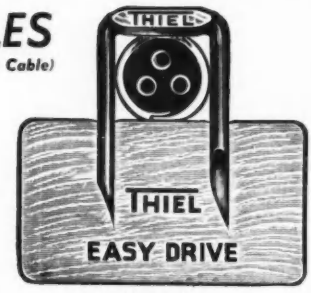
THIEL

FLAT TOP EASY TO DRIVE

BX STAPLES

(For Metallic and Non-metallic Cable)





Old Style Staples

bend, as shown in illustration, when hit hard. Also split the wood.

THIEL Proved

BX Staples are so improved in design that they drive straight, as illustrated —even in oak. Wood does not split.

WON'T SQUASH

The rugged Flat Tops are your bulwark against wasted time, materials, labor. Even under solid blows, they drive true. Your workmen will like them.

DRIVES TRUE

Use THIEL BX Cable Staples and you will find them a vast improvement over any other BX Staples you ever used.

TAKES PUNISHMENT

They are scientifically engineered to absorb the full stress of blows from the hammer. The sharp right-angle bends on the head permit these staples to drive straight and true.

Send for FREE samples.

FOR ELECTRICIANS . .
FOR REFRIGERATOR MEN . .
FOR PLUMBERS . .

THIEL EASY DRIVE "NAIL IT"

They're rugged, won't bend. Serrated teeth hold them secure. The Cadmium plating keeps them rust proof. Packed in cases.

THIEL "EASY ON" STRAPS

Made for ½-inch, thin walls. Hold any job rigid. Will pass inspection. Cadmium plating makes them rust proof. Packed in cases.

- SAVE TIME
- MATERIAL
- LABOR

Sold by Leading Electrical Wholesalers Everywhere

THIEL TOOL & ENGINEERING COMPANY

1417 NORTH MARKET ST., ST. LOUIS 6, MISSOURI

with a solid key and key slot at the other. A bolt and wing nut securely lock the joint when the ring is mounted to the pole.

The device is centered around the pole by four metal knobs mounted to the inner perimeter of the ring at diametrically opposite points. A slight taper of the Marbelite standards keeps the ring from slipping down. The metal knobs are removable and can be replaced with either shorter or longer ones for standards of different diameters. At each knob location there is a pin which extends beyond the outer perimeter of the ring. Locked in a groove near the end of each pin is an automatic fly-cast reel. Suspended from each reel line by swivel and hook arrangement is a cylindrical plumb bob. The lateral distance from the perimeter of the light standard to the center of each reel is sufficient for the plumb bob to clear the base of the standard.

When a mechanic aligns a standard with this device, he clamps the ring around the pole at about eye level (preferably five to six feet above ground); then pulls the plumb bobs down until they are a few inches above the ground around the base. Then, while manipulating the adjusting nuts at the pole base he watches the four bobs. When they all clear the base by the same distance, the standard is in perfect alignment. Should any of the plumb bobs touch the side of the base, additional adjustment is necessary.

By using this device, one man can align a standard in about six to seven minutes. When finished, he makes a chalk mark (code) on the base and moves on to the next unit. This code shows the supervisor on his inspection rounds which standards have been aligned. Final grouting of the base then follows.

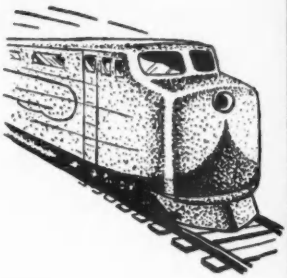
When disassembled, the instrument is placed in a specially designed wood carrying case having partitions for the ring, centering knobs, reels and plumb bobs.

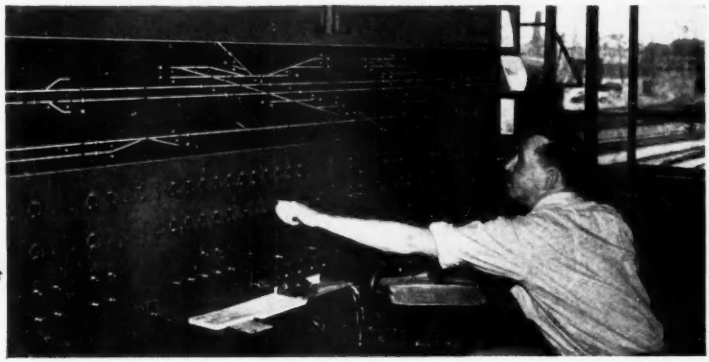
The nominal cost of making this instrument has been repaid many times through the saving in man-hours. One man is now used instead of three and the actual time per pole for alignment has been reduced substantially.

Welded Studs Replace Broken Bolts

MAINTENANCE

Replacing broken bolts is the maintenance man's bugaboo. Whether the bolt breaks off above or below the surface, the broken portion must be removed, the hole retapped, and a new bolt inserted.





REACHING OUT 20 MILES TO LEAD A TRAIN

Railroad signal and communication engineers require dependability above all other things in the equipment which they buy. When it comes to signal cables, which are the vital connecting links between control machines and signals, they have a serious problem. If the cables are installed in the air they are subject to cinders, sparks, heat, sunlight, sleet and rain. If they are installed underground, the cables must be able to withstand long-time exposure to water, soil acids and alkalies, vibration from passing trains, and the cutting effect of sharp cinders. This is brutal punishment. So how to get trains through safely and on time — not once, but every day in the year?

Fortunately, long before the railroads started to use CTC (Centralized Traffic Control) Simplex had developed an insulation that had excellent properties for signal and communication work and was dependably water resistant. That solved the moisture problem. The use of especially compounded neoprene as a jacketing material solved the problem of how to combat sparks, heat, sunlight, rain, etc. This is a typical example of how Simplex Research helps to provide just the right cable for the job.

Simplex Research gave you the first heavy duty, rubber-jacketed portable cord or cable; the first low water absorption insulation; the first rubber-jacketed underground cable. Besides these notable "Firsts" Simplex Research has provided a great many developments which have enriched the art of cable design.

SIMPLEX-ANHYDREX IS A PRODUCT OF SIMPLEX RESEARCH

SIMPLEX-ANHYDREX

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

LOOK TO BRONCO

FOR LEADERSHIP

In the future, as in the past, you can look to Western Insulated Wire Co. to develop and manufacture Bronco portable cords and cables that are...

TOUGHER

MORE FLEXIBLE

LONGER LASTING

MORE CONVENIENT TO USE

SOLD NATIONALLY BY ELECTRICAL WHOLESALE DISTRIBUTORS

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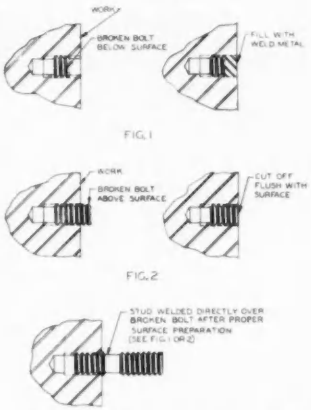
SPECIALISTS in the design and manufacture of portable electrical cords and cables.

PIONEERS in the manufacture of standardized Neoprene-jacketed cords and cables.


WORK
BROKEN BOLT BELOW SURFACE
FILL WITH WELD METAL
FIG. 1
WORK
BROKEN BOLT ABOVE SURFACE
CUT OFF FLUSH WITH SURFACE
FIG. 2
STUD WELDED DIRECTLY OVER BROKEN BOLT AFTER PROPER SURFACE PREPARATION (SEE FIG. 1 OR 2)

STUD IS WELDED over broken bolt after preparatory cutting or hole filling.

With a stud welding gun, however, it's a simple job. No drilling or tapping is required—the stud is simply end welded in place after minor surface preparation.

The Nelson Stud Welding Division of the Morton Gregory Corporation, Lorain, Ohio, reports that one manufacturer has cut his bolt replacement time from 20 minutes to 5 by this method. If a bolt breaks off above the surface, it is first cut off flush. The stud is then end welded directly over the imbedded portion of the original bolt. When the bolt breaks off below the surface, the hole is first filled with weld metal before the stud is end welded in position.

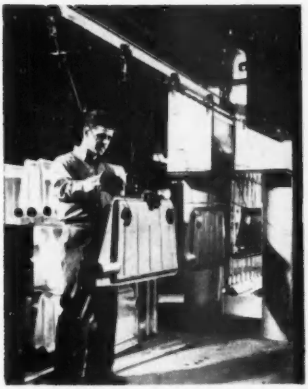
The weld joint is stronger than the metal. Considerable time is saved, and the lightweight, portable gun makes it easy to replace broken bolts regardless of their location.

Radiant Heating Speeds Degreasing

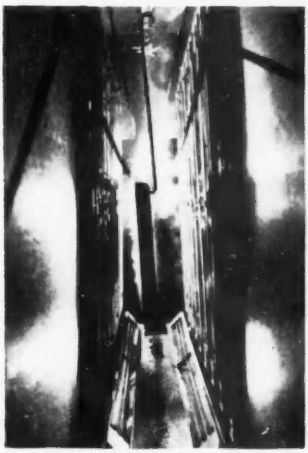
PRODUCTION

An improved and more economical method for degreasing sheet-metal parts for floor furnaces, by replacing the normal vapor method by all-metal electric radiant heaters, is now being employed by the Lawson Manufacturing Company, Pittsburgh. By conveying the sheet metal parts between two banks of 3.6-kw Chromolox radiant heaters, all traces of oil are removed in 36 seconds. The conveyor is a rolling overhead chain-motivated system, permitting continuous operation.

Space is conserved by mounting the heating elements close to the line of travel, and the oven's efficiency has been improved by insulating the space



CONTINUOUS CONVEYOR carries metal parts between two banks of electric all-metal radiant Chromolox heating units in the Lawson Manufacturing Plant. Complete degreasing of 160 metal parts per hour can be achieved for less than one cent of energy per part.



CONNECTED LOAD of the 20 radiant heating elements is 72-w. Units are installed in 3-foot length and glass wool insulation is installed between units to confine heat. Overhead hood and low volume fans remove exhaust fumes from the manufacturing area.

between heaters with glass wool. In all, there are 18 vertically-mounted units and 2 horizontal heaters, half constituting each of the two banks. The connected heating load is 72-kw, concentrated in a space approximately 3 feet long. With the chain moving at a rate of 5 feet per minute, 160 parts can be handled per hour, at an electric energy cost of less than one cent each. Among the advantages of the oven are fast (2 minute) heat-up time, reduced labor costs, more complete and uniform degreasing and faster operation.

RES

EXPLOSION-PROOF CONTROLS

...A COMPLETE LINE OF STANDARD EQUIPMENT!

Wherever R&S electrical control equipment is used for hazardous locations, there's an *extra* margin of safety and protection afforded plants and personnel.

Specifying Russell & Stoll explosion-proof standard units provides this certainty of satisfactory service, because these ready-to-use "packaged" components possess precision uniformity of performance keyed exactly to the job each must do. They eliminate the uncertainties, delays and expense of special design equipment.

R&S enclosure units meet all standards, plus. Major advantages include wall sections permitting a wide variety of conduit arrangement and ample wiring space. Removable covers for front accessibility facilitate close grouping and easy maintenance of control and power units.

WRITE FOR CATALOG NO. H47-4.

RUSSELL & STOLL COMPANY, INC. • 125 BARCLAY STREET, NEW YORK 7, N.Y.

RUSSELL & STOLL

PRECISION-BUILT ELECTRICAL EQUIPMENT—SINCE 1902

"Hang Up Your Gloves... the Fight's Called Off!"

PERMAFLECTOR PETE SAYS:

"Profit with Permaflectors"

Pittsburgh Permaflector Lighting Equipment was designed with the contractor in mind. There is no fighting with parts, no tangling with wires, no prying or pushing to make the units align when you work with Pittsburgh Permaflector Equipment.

Whether the units are fluorescent, incandescent or a combination of both—whether they're being ceiling recessed, surface mounted or pendant mounted—you'll find that they go up quickly and easily.

Be sure the job is profitable. Work with Pittsburgh Permaflector Equipment. Then you can estimate costs down to the last penny and be sure you won't run into any hidden "bugs."

WANT PROOF? **Then send for complete information on the Pittsburgh Permaflector line for commercial, institutional and industrial lighting.**

"Pittsburgh" Permaflector

Pittsburgh Reflector Company

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DISTRIBUTED BY ELECTRICAL WHOLESALERS EVERYWHERE • PERMAFLECTOR LIGHTING ENGINEERS IN ALL PRINCIPAL CITIES

Modern Lighting

7 FOOTCANDLES were formerly delivered to sales counters by luminous globes in Allentown's Zollinger-Harned department store. Light was uneven, harsh, and unsightly.

50 FOOTCANDLES are now obtained with surface-mounted installation combining Daybrite Plexoline fluorescent units and fixed accent lensed luminaires.

Seven-Fold Light Boost For Store

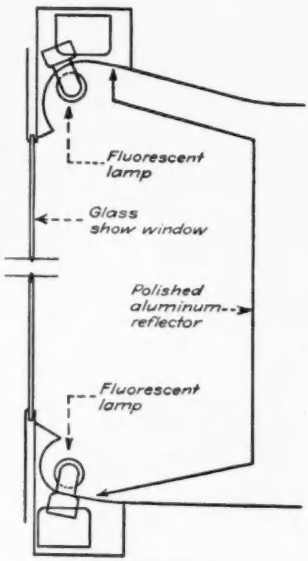
A new fluorescent-incandescent combination lighting system, installed in the Zollinger-Harned department store in Allentown, Pa., has raised illumination levels seven fold while increasing the electrical load only three times. As indicated in the accompanying photographs, the former installation consisted of luminous bowls, suspended two to a bay, producing deep shadows, uneven distribution and an average light level of only 7 footcandles. The connected load was 20.5-kw.

At present, in-service illumination averages 50 footcandles, ranging from 55 directly under the fixtures to 45 along wall lines at counter-top levels. The connected load is now 60.3-kw. The installation consists of Daybrite Plexoline units mounted in pairs, side by side, combining in each installation eight 8-foot T-12 Sylvania warm white fluorescent lamps operating at 425-ma. Surface-mounted at either end of the fluorescent installation is an incandescent accent light, housing a 300-watt lamp behind a 13-inch Holophane lens. Since side panels of the fluorescent units are of ribbed Albalite glass, and circular accent units have luminous sides, adjacent ceiling areas are illuminated by lateral light components.

Installed by electrical contractors Orlande-Diefenderfer of Allentown, the installation is the design creation of Joe Freeman, Allen Electric Company; Mitch Davis, Hopkins Brothers; F. Glick and Sherwood Cota, Pennsylvania Power and Light Company.

Fluorescent Strip Frames Show Windows

The attention-commanding qualities of special displays in the Chrysler International Automobile Salon, New York City, are largely due to the fluorescent strip lighting framing the show windows. Designed by Edward F. Caldwell & Company, Inc., the strips are well concealed from public view by means of polished aluminum reflectors that sweep into the window frames. With light coming from all sides of the displays, shadows are entirely absent and details are presented clearly.



ALUMINUM REFLECTORS are combined with display window frames in the Chrysler International Automobile Salon.

ROLLING TOWERS

RUGGED!
LIGHT!
ECONOMICAL!

YOUR BEST BUY

"Your best buy" is the rolling tower that's light, rugged and, most important—*economical.* The WACO Rolling Tower gives you the strength of steel at less than ½ the cost of similar aluminum equipment.

WACO

WACO'S Speedlock assembly is fast and simple. Speedlock has no bolts or clamps to tighten or adjust—no loose parts to become lost. A simple, but rugged lock drops into place to hold end frames and cross braces in rigid alignment.

WACO

Additional WACO features: Built-in ladder—Rubber-tired braking casters—Stradles furniture, desks—29" model fits through doors, halls.

OUR SECRET OF SPEED

YOUR GUARANTEE OF SAFETY

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WACO Distributor Stocks are available in major cities for SALES—RENTAL

WRITE TODAY FOR DESCRIPTIVE LITERATURE

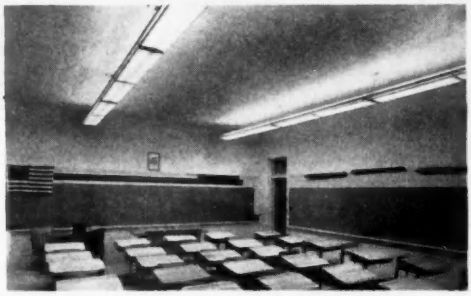
WILSON-ALBRECHT CO. INC.
3562 WOODDALE AVENUE
MINNEAPOLIS 16, MINNESOTA

INDIRECT FIXTURES utilizing 1000-watt inside frosted lamps and mirrored-glass louvered downlights with 500-watt lamps combine to produce better than 60 footcandles of incandescent illumination on counter tops of McCrory's new department store in Newark, New Jersey.

Incandescent System Lights Merchandise

Even distribution of illumination on merchandise, walls and ceiling achieves a pleasing 60-footcandle level on counters of McCrory's new department store in Newark, New Jersey. Two types of incandescent lighting are installed to produce this sales-promoting variety; indirect units utilizing 1000-watt inside frosted lamps, and direct units employing 500-watt lamps. Direct units are mirrored glass louvered downlights, recessed flush with the 12-foot 2-inch ceiling, and spaced on 18-by-19-foot centers. The indirect units are suspended 3 feet beneath the ceiling on a spacing pattern measuring 36 by 38 feet. Light meter readings record 25 footcandles on counter tops when indirect units only are lighted, and 36 footcandles when only downlights are in operation. With all units in use, the combined illumination totals slightly better than 60 footcandles. This average is fairly constant throughout the sales area, varying only a few footcandles between lighting units. The system, utilizing fixtures manufactured by Curtis, was installed by the Lightning Electric Company of Newark, and was designed by architect W. M. Simpson. Merchandise is presented effectively.

HATFIELD ELECTRIC COMPANY of Cleveland installed Frink 4-lamp 96T8 slimline fixtures in continuous rows to illuminate estates-trust office of Central National Bank of Cleveland's Prospect Avenue building. Operating at 200-ma., louvered fixtures deliver 65-fc average to working surfaces. Lighting design was by W. E. Conley and T. C. Sidlo, General Electric.



This
Junior High School

Is SENIOR

In Lighting!

JOB: JUNIOR HIGH SCHOOL, ARDMORE, OKLAHOMA. Electrical Contractor: Baber Electric Company, Ardmore, Oklahoma. Lighting Equipment: Litecontrol #5328, 2-lamp Slimline louvered fixtures, hung on 12" stems. Fixture cutoff 35° crosswise, 25° lengthwise. Intensity: Two continuous rows produce approximately 30 footcandles average in service, at desk height.

Take a look at this cheerful classroom . . . at the eye-filling home economics lab . . . and at those eye-saving Litecontrol No. 5328 Slimline Louvered Fixtures. Matter of fact, the entire school is Litecontrol-equipped.

Shallow-louvered and clean in line, the Slimline blends beautifully with functional design and furnishings. Performance, of course, is in the Litecontrol tradition of maximum efficiency for the job . . . mounting arrangements are versatile . . . and, with louvers hinged at either side, re-lamping and maintenance are easy, speedy, with no special tools required.

On your next difficult or unusual lighting problem, call or write your LITECONTROL Representative.

LC

LITECONTROL *Fixtures*

KEEP UPKEEP DOWN

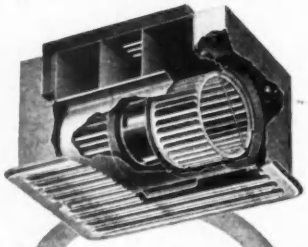
LITECONTROL CORPORATION, 36 Pleasant Street, Watertown 72, Massachusetts

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

Announcing

THE ALL NEW *TRADE-WIND* TWIN WHEEL 300 cfm CLIPPER VENTILATOR

Model 1501 is packed with features • Sensationally priced • Now in production



DUAL WHEELS
FITS IN 8-INCH JOIST SPACE
FULL 300 CFM — CERTIFIED
EXTRA QUIET OPERATION
EASIER TO INSTALL
INTERCHANGEABLE DISCHARGE
SIMPLIFIED CONSTRUCTION
STANDARD 3⅛" x 10" FURNACE DUCT

For the first time Trade-Wind offers a twin wheel ceiling ventilator with interchangeable discharge that develops a full, certified 300 CFM, yet is priced competitively with ordinary ventilators. Equally important to you, Model 1501 *is now in production* and deliveries already are being made.

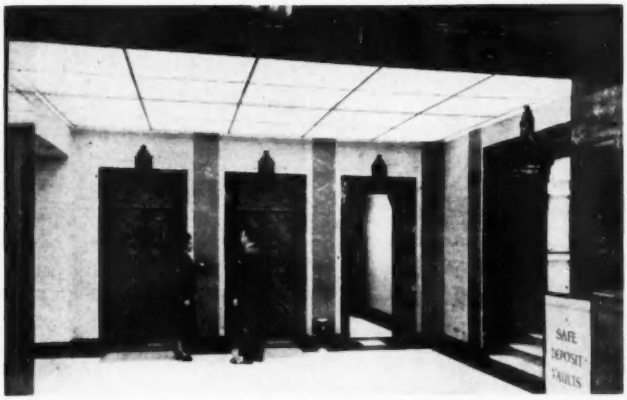
Write or wire us today for the complete story on the biggest ventilator value in 1951. Mail handy coupon now.

Trade-Wind Motorfans, Inc.
5709 S. Main St
Los Angeles 37, Calif

Please rush your Bulletin 625 on the all new Model 1501 Trade-Wind Clipper.

NAME _____

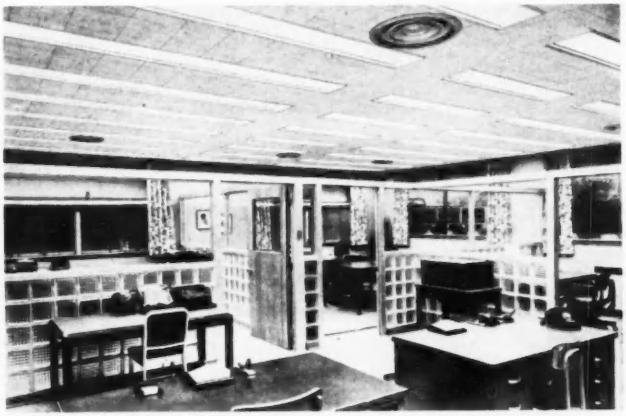
ADDRESS _____



SLIMLINE LAMPS on 24-inch centers, mounted 9 inches above this corrugated plastic ceiling, provide 50 footcandles of illumination to bank elevator lobby.

Corrugated Plastic For Luminous Ceilings

The elevator lobby of the Central Bank of Cleveland's Prospect Avenue office is distinguished by a 13-by20-foot luminous ceiling consisting of approximately 4-by-4-foot Rohm and Hass corrugated plexiglass sheets suspended by a T-bar framework. Standard warm white 6-foot T8 slimline lamps at 200 milliamps are mounted on 24-inch centers 9 inches above the 10.5-foot ceiling elevation. Illumination at waist height is 50 footcandles. The installation was by the Hatfield Electric Company, while the design was by W. E. Conley and T. C. Sidlo, lighting consultants of the General Electric Company.



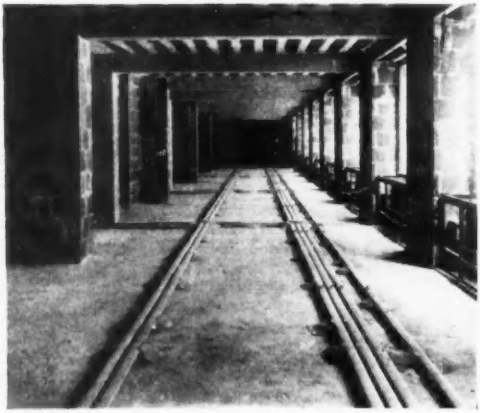
55 FOOTCANDLES of low-brightness light is delivered to desk tops from this single-lamp aluminum troffer installation in Milwaukee, Wisconsin.

Low Brightness Lamps In Deep Troffers

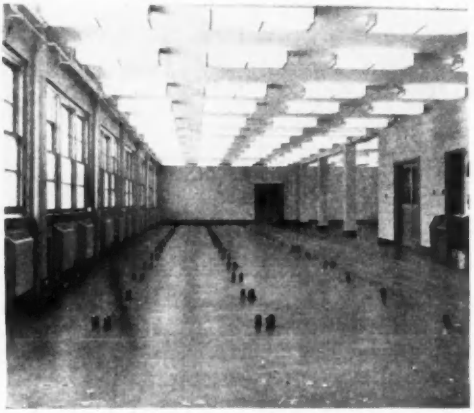
The William D. Kyle Office Building in Milwaukee, Wisconsin, combines recessed low-brightness lighting with an unusually pleasing general atmosphere. Light finishes of floors, walls and window shades plus the liberal use of glass block for partitions and a cream colored acoustical ceiling contribute to high-reflectance surrounds, while air conditioning adds to the comfort.

The lighting system, installed by the Barg Electric Company and designed by Bill Kuhnke, lighting engineer with the Wisconsin Electric Power Company, consists of single-lamp matt aluminum troffers, supplied by the Solar Light Company and utilizing 60-inch T-17 40-watt low-brightness lamps. Fixtures are installed singly and in pairs, with rows three feet apart for an approximate 3.5 watts per square foot load density and a maintained level of 55 footcandles.

Designed for Contractors
by Wakefield
The Pre-Installed Strap
. . . vital first step in
easy one-man installation
The F. W. Wakefield Brass Company · Vermilion, Ohio



G-E Fiberduct raceways provide single-, double-, or triple-duct service—can be laid in a variety of patterns to concentrate distribution over any portion of floor.



Large G-E Fiberduct raceways provide ample facilities for the heaviest electrical demands—permit installation of outlets right where they're needed in a few minutes.

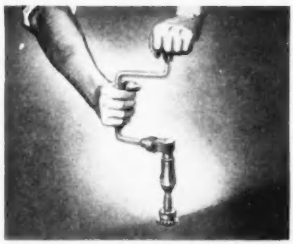
Provide Complete Underfloor Distribution with nonmetallic G-E Fiberduct Raceways

Plan now to avoid materials problems and still provide ample underfloor distribution with nonmetallic G-E Fiberduct raceways.

G-E Fiberduct raceways offer the kind of over-all distribution that today's expanding electrical requirements demand. They put power where it's needed when new electrical equipment and changing floor layouts call for flexible distribution.

Fiberduct raceways make it easy to install additional outlets at all times. An electrician cuts a hole through the floor and the duct, pulls wires through and installs the outlet. New distribution is provided by merely pulling additional wires through the raceway. There's no interruption of building facilities . . . no annoyance to building tenants!

Complete specifications and installation data are available from your General Electric Construction Materials distributor. For a free copy of the G-E Fiberduct Data Manual, write to Section C57-618, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.



To add an outlet, simply make a small opening in the floor over the raceway, fish wires through, connect outlet.

Fiberduct Underfloor Raceways

You can put your confidence in —

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Save time, trouble and money. We will tell each manufacturer to send you the information you want. Instead of writing many letters to get the material you need, just fill in this easy-to-use postcard and we will do the rest. For years we have been rendering this service on catalogs and bulletins . . . now we expand this service to include every department. It's free . . . It's as useful as you make it.

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If you want to know more about something which is advertised in this issue, put the number of the page on which the advertisement appears in one of the squares at the bottom of the card. If you want further information on the product advertised on page 16, for example, just put a 16 in one of the squares. When more than one advertisement appears on a single page, include the manufacturer's initials together with the page number (16-A&B)

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Electrical Construction and Maintenance is written for you by a large staff of editors and consultants, each an authority on some phase of the business. They will be glad to give you expert advice and answers to your questions.

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Reader Service Department
ELECTRICAL CONSTRUCTION AND MAINTENANCE
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Do you have a problem in wiring layout, motor control, lighting technique?
Ask the editors.

Do you want advice on cost analysis, billing procedures, market conditions, or government regulations?
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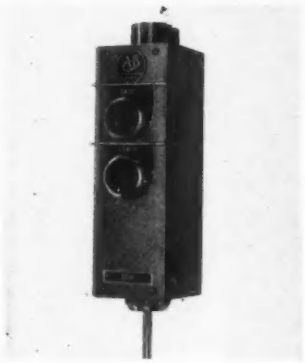
To secure further information on new product or new catalog and bulletin items listed elsewhere in this section, use the card on the other side.

Product News



Control Station (1)

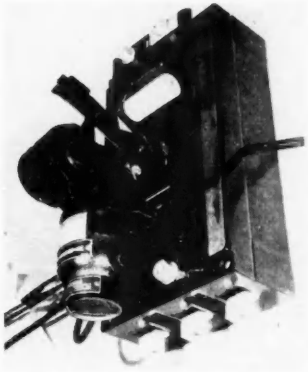
Bulletin 800T pendant pushbutton station, which is a new oiltight control station, has been announced. It is designed for use as a portable control or for suspension above a machine where it may be reached while the operator is near his work. Pendant pushbutton stations may be obtained in sizes having three units including the stop, to 10 units including the stop. Standard stop unit is a wobble stick in the bottom of the enclosure, but can also be furnished as a mushroom head mounted in the bottom or in the front of the enclosure. All enclosures are equipped with oiltight control units. Each enclosure has a cable anchor at the top.

Allen-Bradley Company, Milwaukee, Wis.

Grounded Receptacle (2)

Announcement has been made of the addition to this line of a 2127G NEMA grounded receptacle, for parallel blade plug cap or the new NEMA grounding plug. Rated at 15 amp, 125 volt, this receptacle is provided with double wipe contacts, and has the same dimensions as the 2127 receptacle so that it is possible to replace existing 2100 Wiremold installations using the 2127 ungrounded receptacle, with the new standard. Capacity of 2100 Wiremold with 2127G installed is 6 No. 12 conductors.

The Wiremold Company, Hartford 10, Conn.



Breaker (3)

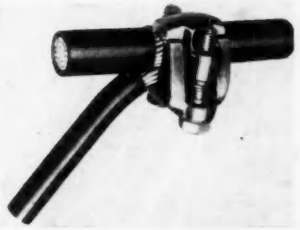
The type AB breaker with an improved motor-operated mechanism, for applications protecting critical electronic circuits, is available. Features of this 225-ampere, K-frame breaker are: a more positive adjustment of the motor mechanism; a change in the location of the handle used for manual operation, reducing the overall height of the breaker; motor mechanism can be removed from breaker and replaced. In addition, terminals are extended so that it is not necessary to remove breaker cover to make cable connections. It also can be mounted without removing its cover.

Westinghouse Electric Corporation, Pittsburgh 30, Pa.

Ballasts (4)

Announcement has been made of a new series of one-light slimline ballasts. They are for all one-light units for 120, 200, 300 and 430 ma in the 42-, 48-, 72- and 96-inch sizes. Cross section dimensions of ballasts is same size as conventional two-light, 40-watt streamline ballasts. Width is $2\frac{1}{4}$ inches and height is $1\frac{5}{8}$ inches.

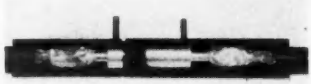
Universal Manufacturing Corp., 695 Broadway, Westwood, N. J.



Service Tap (5)

A new service tap has been added to this line of electrical connectors. The tap is cast of high strength copper alloy for heavy-duty service connections for both inside and outside use. To permit insertion of conductors, casting is designed to swivel. Construction is such that it keeps tap assembled when clamp is open. Serrations on both body and cap prevent cables from working loose after tap is installed. Conductors are forced into contact by means of two standard hex head cap screws. Spacer is available if desired for separating individual conductors. Available in sizes from No. 2 to 1000 Mcm (Main). No. 10 to 1000 Mcm (Tap).

O. Z. Electrical Manufacturing Co., Inc., 262 Bond St., Brooklyn, N. Y.



Connector (6)

Announcement has been made of a new connector, called Caddy Quick. Male and female ends are attached to their respective sections of cable by the Cadweld process. Copper oxide and aluminum are dumped into a graphite crucible and ignited with a spark. Reduction of copper oxide by the aluminum produces molten copper which flows over the quick connector end and the cable welding them together. The 4/0 connector can be used on any size cable from 1/0 to 4/0. Capacity is 500 amp. Connectors are interchangeable. Female end is completely enclosed by the insulator. Fiber pins lock the insulators to the connector body.

Erico Products, Inc., 2070 East 61st Place, Cleveland 3, Ohio

SPANS THE NATION
MODERN FITTINGS FOR
• thinwall conduit • rigid conduit • metallic and n
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manufacturers for over 30 years
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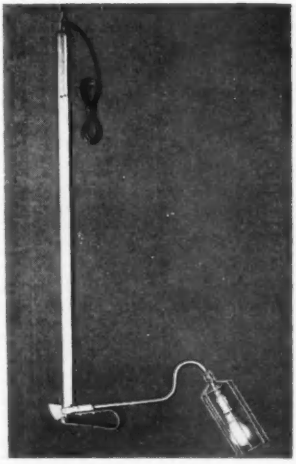
representatives in principal cities
midwest
midwest electric mfg. co. 1639 walnut st. • chicago 12, ill.

Meter (7)

A new hook-on power-factor meter, Type AK-3, which permits direct measurement of power factor without cutting conductors or interrupting electrical service, has been announced. It may be used on any balanced three phase circuit. It gives direct power-factor readings in circuits with voltages ranging from 100 to 600 volts and currents from 15 to 600 amps. Instrument is designed for use in industrial plants where maintenance of high power factor is an important consideration. To operate, user clips voltage leads to potential source, clamps hook around conductor and rotates selector dial to obtain reading.

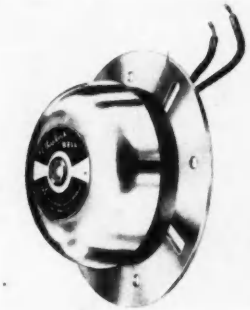
General Electric Co., Schenectady 5, N. Y.



Lighting Unit (8)

A new overhead suspension, underside illuminator, called "Anchorlite," has been developed. It has many industrial uses wherever illumination is required temporarily inside equipment such as freight cars and trucks and trailers while at loading platforms, or underneath equipment in auto service stations, repair shops, locomotive and railroad car shops and warehouses and stock rooms for lower bin lighting. It is designed to swing free on a swivel when suspended on a stationary bracket. It may also be suspended from a messenger wire to slide the length of a bay. A spring-loaded telescopic device provides up to three feet of expansion in length. It can be supplied with a mercury switch in the cord which automatically turns on light when anchored in position for use and turns off light when released.

Pyle-National Company, 1334 N. Kostner Ave., Chicago 51, Ill.



Midget Bells (9)

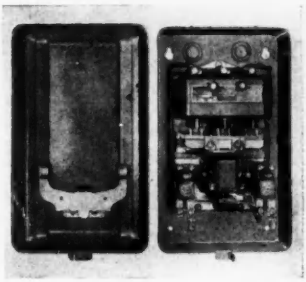
A new line of midget bells has been announced. A basically new principle in ac contactless vibrating bell construction is used. Bell is underdome, solenoid and plunger type. Prolonged vibration of bell shell results in greater sound carrying power. Available in 2½ or 3 inch diameters, for operation on standard voltages; with adapter plate for mounting on standard outlet boxes. Available in a variety of mounting arrangements and finishes.

Signal Engineering & Mfg. Co., 154 West 14th Street, New York 11, N. Y.

Fluorescent Lamp (10)

A new improved fluorescent lamp in which the lumen output per watt is increased has been announced. This lamp incorporates a new manufacturing technique in the colors Candelite and Vis-A-Ray. Candelite was originally rated on the 40 watt lamp at 51 lumens per watt and is now rated at 60 lumens per watt. Vis-A-Ray, previously rated at 58 lumens per watt is increased in the new lamp to 63 lumens per watt.

Duro-Test Corporation, North Bergen, N. J.



Motor Starter (11)

The new CY-2 starter for ac motors introduces a new arc interrupting principle. It features the combined use of multi-turn magnetic blowouts with twin break contacts. A steel case, enclosing each arc chamber, carries the flux. Two different actions occur, changing each half cycle with the reversals of the current. In one current direction the arc is forced to the outer edge of the upper contact, lengthened and rotated. In the other, the arc is rotated and forced to the middle of the upper contact. The arc moves constantly. In its forced rotation, it must continually move from a hot spot to a relatively cool spot. All parts in the arc chamber are copper, brass and steel.

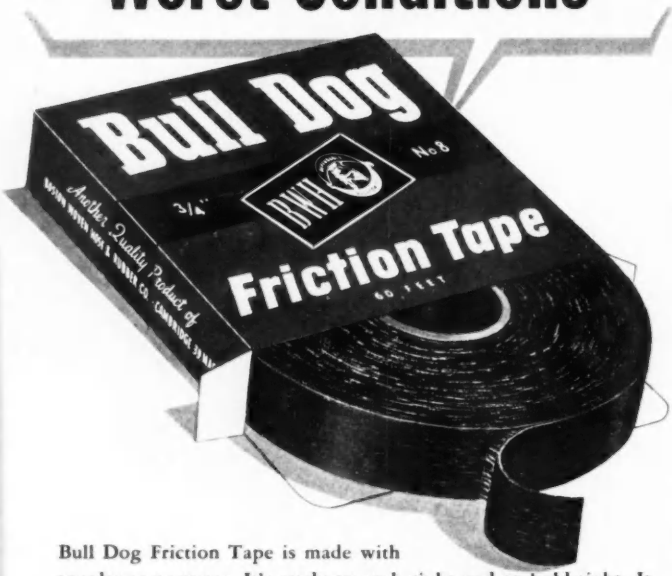
Clark Controller Company, 1146 East 152d Street, Cleveland 10, Ohio

Lighting Unit (12)

Announcement has been made of the development of the 9300 series of surface-attached Holoflux luminaires. The styling and appearance of these new units with their extreme shallowness, 4½ inches, simulate recessed construction. There is brightness control both across and along the axis of the lamps. They can take two or four fluorescent lamps of either the conventional bipin or the new instant-start single pin type, both 4-foot and 8-foot. Units feature easy removal of Controlens and snap shut hinged doors. They are for use in commercial and institutional buildings, general and private offices, classrooms and drafting rooms, schools and stores, banks and libraries.

Holophane Company, Inc., 342 Madison Avenue, New York 17, N. Y.

The Best Tape Made for the Worst Conditions



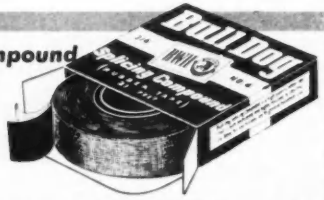
Bull Dog Friction Tape is made with toughness to spare. It's made to grab tight and to hold tight. It will never give you any trouble with raveling, fraying — or with leaving unsightly, messy edges. It will not dry out on the roll or on the job. Its super adhesiveness will last and last — will withstand aging and protect your good work.

For all these reasons we say — as do electrical men in every phase of the business: "In friction tape, Bull Dog's the Buy."

You buy and try it — and you'll say so too!

Use Bull Dog Splicing Compound for Top Notch Insulation

Bull Dog Splicing Compound is unsurpassed for high resistance to electricity and water. Self-vulcanizing into a solid, watertight joint. Buy it from your Bull Dog Friction Tape supplier.



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BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in all Principal Cities

PLANT: Cambridge, Mass. • P.O. Box 1071, Boston 3, Mass., U.S.A.

Manual Starter (13)

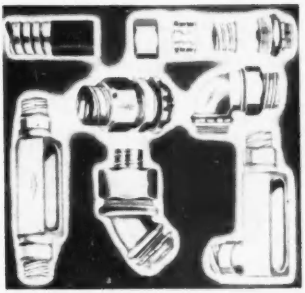
A new Class 2510 Type A fractional horsepower manual starter designed to control and protect single phase ac and dc motors of 1 hp and less has been announced. Both single and double-pole devices are available. Double-break contact has quick make and break action and contact tips are of silver. Starter incorporates trip-free overload protection. Interchangeable overload relay units are accessible from the front. Line and load terminals are arranged for straight-through wiring. Three types of enclosures are available as well as the open type starter: general purpose, water and dust tight, and explosion-resistant. Enclosure can be supplied with a pilot light for 115 and 230 volt operation without increasing overall dimensions. Water and dust-tight enclosures can also be supplied with a pilot light. Standard switch box and flush plate can be used with open type switch unit.

Square D Company, 4041 N. Richards Street, Milwaukee 12, Wis.

Connector (14)

A new hex type watertight service entrance cable connector is available. These connectors cover the range of service entrance cable from 8/2 round to 4/3 oval cable. By the use of projections inside the connector, the bushing is prevented from turning and since the bushing is tapered it closes tightly around the cable. A feature is the use of Duxseal compound under the hex nut which is pressed out and can be formed around the cable to protect the rubber bushing and further protect against the entrance of moisture.

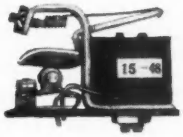
M. & W. Electric Mfg. Co., Inc., East Palestine, Ohio



Fittings **(15)**

Vap-Oil-Tite is a new liquid and vaportight, positive ground fitting used to connect synthetic covered flexible metallic conduit. One of the features is the threaded bushing or ferrule that threads into the spiral between the convolutions of metal core of conduit, insuring a positive ground. This bushing makes it unnecessary to burr the ends of metal core after cutting because of a collar that covers the rough edges. They are furnished in sizes from ⅜ inch to 2 inches.

Simplet Electric Company, 3602 Potomac Ave., Chicago 51, Ill.



Relay **(16)**

A new motor starting current relay for single-phase, capacitor-start motors is designed to replace obsolte and troublesome centrifugal starting switches on motors ranging in size from ⅙-hp., 110-volt to approximately 5-hp., 220-volt single-phase; is an ideal replacement part for motor repair shops and industrial electrical maintenance departments. Relay is connected in series with motor running winding; energizes starting winding when motor is placed across the line; kicks out starting winding with semi-snap action when motor reaches running speed. Five different coil sizes are available for same relay structure to accommodate above range of motor sizes. Simple set-screw mechanism adjusts relay for specific motor operating characteristics. Assembly is housed in metal enclosure which can be mounted to motor in any convenient position.

Lewus Electric Company, 1254 W. Harrison St., Chicago 7, Illinois.

Unsurpassed for Quality

NEW 4100 SERIES

Levolier®

INDUSTRIAL SOCKETS

Another new McGill product with the many quality extras associated with LEVOLIER Switches for over thirty years. Applying this proven mechanism to a socket eliminates costly socket replacements in rugged industrial service. Rated at 660 Watts 250 volts the LEVOLIER No. 4100 has ⅛" cap. 4102—PENDANT. 4103—⅜" cap. Brushed brass finish. Underwriters' Laboratories Inspected.

...leads on 4 points

1 HEAVIER SCREW SHELL
Heavily constructed throughout with bronze screw shell .006 heavier than standard — for added strength at the lamp base. Extra thick fibre insulating liner.

2 USES LEVOLIER SWITCH
Dependable rotary action—universal lever operated with pull from any direction. Convenient terminals.

3 DOUBLE WALL THICKNESS
Cap and casing overlay resulting in double wall thickness over the mechanism — provides added support for the lever.

4 CAP AND CASING LOCK
Threaded collar that locks cap and casing together — prevents separation with actuating pull. Cannot slip over shade threads.

MODEL 25
6 amp "T" rated — 125 volt; 3 amp — 250 volt. Toggle switch.

MODEL 71
6 amp "T" rated — 125 volt; 3 amp — 250 volt. 15/32" thick.

MODEL 41
6 amp "T" rated — 125 volt; 3 amp — 250 volt.

MODEL 1010
10 amp "T" rated — 125 volt; 5 amp — 250 volt.

AVAILABLE FROM YOUR ELECTRICAL WHOLESALER

For New Catalog No. 49 Write: McGill Manufacturing Co., Inc., 450 N. Campbell St., Valparaiso, Ind.

McGILL® electrical specialties

ONLY McGILL MAKES *Levolier* SWITCHES

DON'T LET DUST, DIRT OR WEATHER SHORTEN THE SERVICE LIFE OF YOUR MOTORS

BALDOR

Streamcooled

BALL-BEARING MOTORS

These motors are SOLIDLY ENCLOSED, cooled by an outer-mounted fan in the bell-end. They cannot inhale dust or dirt and will operate efficiently in all kinds of weather.

BALDOR Streamcooled Motors require no dismantling for cleaning. Thus *less servicing* . . . no interruption of pumping or other service. Let us tell you more about these long service-life BALDOR Motors.

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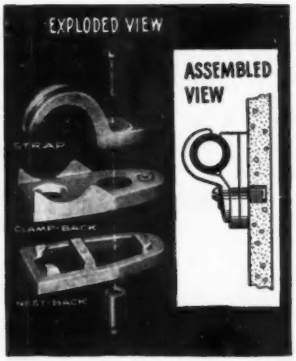
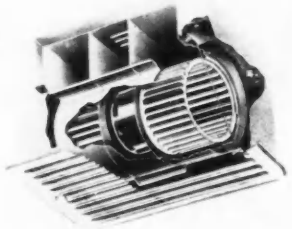
Sold and serviced in more than 300 Trade Centers



Fitting **(17)**

Announcement has been made of a new nest back, which is a supplementary spacer that fits snugly under the clamp back and makes possible additional spacing away from the mounting surface. As nest backs fit securely into each other, conduit can be installed at any desired distance from walls or ceilings. Wherever cleanliness, corrosion prevention or paint coverage call for extra room behind the conduits, nest backs may be used. They are also for use as shims to offset low spots in uneven surfaces. They are made of malleable iron, hot dip galvanized, and available in a full range of sizes for rigid conduit and EMT.

Gedney Electric Co., RKO Building, Radio City, New York 20, N. Y.



Ventilator **(18)**

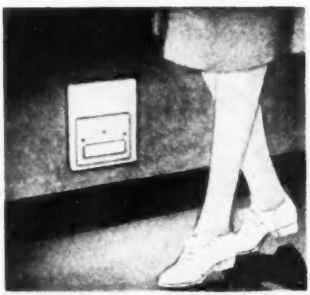
A new ceiling model ventilator for kitchens and all small rooms up to 1000 cu. ft. has been announced. It incorporates dual blower wheels and interchangeable horizontal and vertical discharge. Model 1501 develops a 300 cfm using a 1/30 hp. motor turning the twin 6 inch squirrel cage blower wheels at 1450 rpm. Motor is isolated from greasy air stream. The discharge takes standard 3½ inch by 10 inch furnace duct. Metal housing of the unit is permanently installed within the joist space. A bead around the bottom of housing ¼ inch from the edge locates the proper depth to allow for plaster ground. Blower is installed by means of clamps while grille is installed or removed by two thumb turns. Unit is 7¼ inches high, 8¼ inches wide and 14 inches long.

Trade-Wind Motorfans, Inc., 5725 S. Main St., Los Angeles 37, Calif.

Fluorescent Unit **(19)**

Announcement has been made of a new fluorescent luminaire, known as Convaire, for industrial lighting. It uses two 40-watt fluorescent lamps and comes in 49-⅛ and 98-¼ inch lengths. It uses the new GE89G 343, two lamp, small cross-section ballast. Unit can be installed individually or in continuous rows, pendant or surface mounted on stems, chains or messenger cable. Two types of open end reflectors are available, solid top or apertured top.

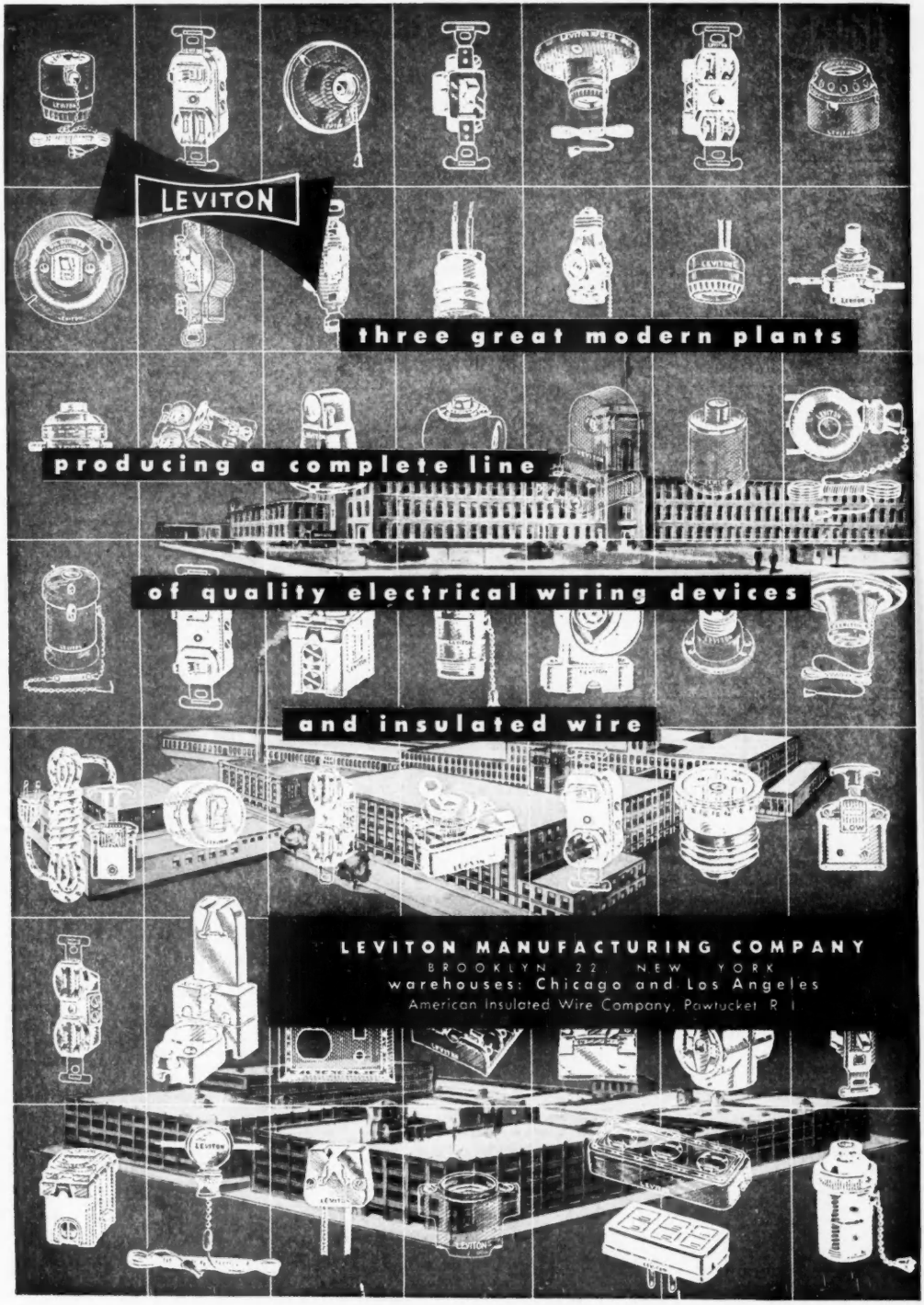
Miller Company, Meriden, Conn.



Night Light **(20)**

Announcement has been made of a new "Glo-Ray" unit, which is designed to provide night lighting for corridors, halls, lobbies, theatres, stock rooms, stairways, etc. It uses one 15 or 25 watt frosted incandescent lamp. Lamp housing is finished in black enamel. Housing is 4 inches by 6 inches and requires 3 inch recessing depth. Cover is zinc plated and furnished unpainted, so that it may be finished in the same color as the wall, or any color desired. Feed wires can be inserted at top, bottom or either side of the box and four knockouts are provided for this purpose. A shutter arrangement inside the cover controls the amount of light which is permitted to pass through the cover glass.

Curtis Lighting, Inc., 6135 West 65th Street, Chicago 38, Ill.


LEVITON
three great modern plants
producing a complete line
of quality electrical wiring devices
and insulated wire
LEVITON MANUFACTURING COMPANY
BROOKLYN 22, NEW YORK
warehouses: Chicago and Los Angeles
American Insulated Wire Company, Pawtucket, R. I.

Make Stronger, Safer Pigtail Splices!

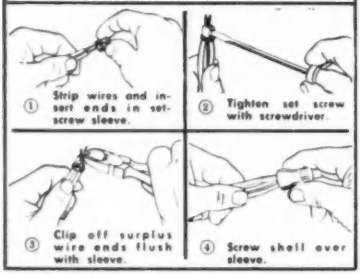
THE NEW **IDEAL**

SET SCREW

WIRE CONNECTOR

PERMITS VISUAL INSPECTION OF JOINTS AT ANY TIME

...Easy to Use...Safe


① Strip wires and insert ends in set-screw sleeve.
② Tighten set screw with screwdriver.
③ Clip off surplus wire ends flush with sleeve.
④ Screw shell over sleeve.

***Approved** FOR 600 VOLTS AS PRESSURE CABLE CONNECTORS FOR GENERAL USE*

● With IDEAL Set-Screw Connectors you can make perfectly insulated, *super-safe* splices in branch circuit wiring, fixture hanging, machine and appliance hook-up—in just a few seconds per splice! They let you make changes in circuit layouts easily—just unscrew and re-use the same connectors! Or inspect joints at *any* time! Extra-long, extra-strong—IDEAL Set Screw Connectors offer you a new high safety factor that eliminates chance of flash-overs at higher voltages and insures against service failures. They are corrosion-resistant—shake-proof—pull-proof—built to be safe for a lifetime by IDEAL, for 27 years the contractor's first choice for precision-built, top-performance wire connectors. Try IDEAL Set-Screw Connectors on your very next job!

IDEAL FREE SAMPLE

IDEAL INDUSTRIES, Inc.
1041 Park Avenue, Sycamore, Illinois

Please send us free samples and catalog information on the new IDEAL Set-Screw Connector.

NAME _____

COMPANY _____

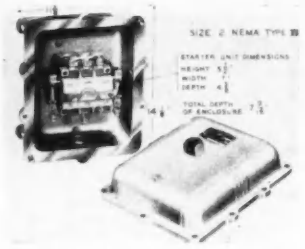
ADDRESS _____

CITY _____ ZONE ___ STATE _____

Two sizes, listed by Underwriters' Laboratories, Inc. for all common wire combinations

UL

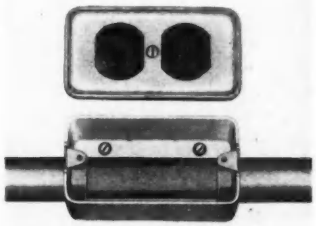
Sold Through America's Leading Distributors



Magnetic Starters (21)

A new line of Explo-Safe and weatherproof magnetic starters has been announced. Featured is a compact and rugged Feraloy cast housing in combination with the "RA" (right angle) type of mechanism. Motor controls are available in sizes 0, 1, 2, 3 and 4 for a wide variety of uses. Typical applications are found with manufacturers of chemicals, explosives, fertilizers, soaps, paints, papers, petroleum, pharmaceuticals, plastics, rubber, textiles, and in processing plants such as woodworking or grain milling. Features are light weight; straight-thru wiring and ample working space for installations. Terminals are accessible from front, as are the contacts. Line and load may be completely separated; circuits immediately identified.

Arrow-Hart & Hegeman Electric Company, 103 Hawthorn St., Hartford 6, Conn.

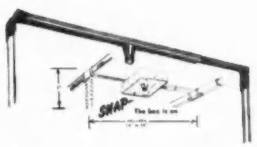


Service Fitting (22)

A new service fitting for the Florduct raceway line has been announced. Known as Catalog No. 761-B, the body fitting is made of 14-gauge steel and is designed to preserve a continuous raceway base. It is so constructed as to eliminate hazards caused from abuse and water seepage and is electro-galvanized to make it rust-resistant. Fitting housing is installed over the raceway base without cutting the raceway. After installation of the housing and the "laying-in" of conductors, the capping of the two-piece Florduct raceway is snapped into place and the receptacle wired. While fitting is furnished with a duplex receptacle, it will

accommodate all standard devices. The new fitting is fastened directly to the floor. Positive grounding is assured due to the manner in which the bottom of fitting grips the base of the continuous raceway which runs through the fitting.

National Electric Products Corporation, Chamber of Commerce Bldg., Pittsburgh 19, Pa.



Bar-Hangers **(23)**

Announcement has been made of new adjustable hung-ceiling bar-hangers, complete with "Snap-On" studs and end-straps. It requires three steps to install—after extending bar-hanger to proper width, lay it on top of channels, wrapping end-straps around each channel. After positioning stud, "snap-on" the box (any type or depth).

Fast Lok Manufacturing Company, Bridgeport, Conn.

Solenoid **(24)**

A new solenoid, in the medium size range, has been announced. It is available in three voltage ranges—110, 220, and 440—with $\frac{3}{8}$ inch maximum stroke, and rated pull or push ranging from 4 to 10 pounds gravity. It is dimensionally interchangeable with standard solenoids. Features are: simplified construction, enabling disassembly for coil replacement without removing solenoid from original mounting; fan-proof laminations assembled by an electro-hydraulic forging process; A "T" shaped armature; low temperature operation because of small coil current required and shockproof backstop.

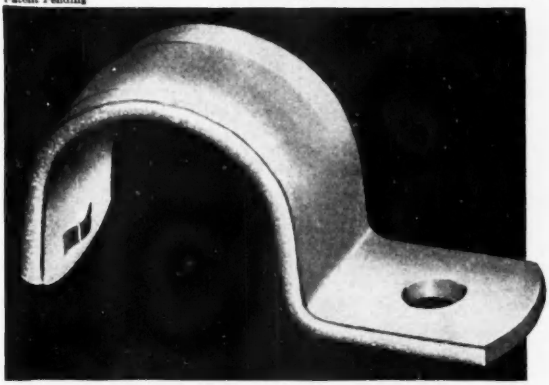
Practical Electric Co., 4505 Oakwood Blvd., Melvindale, Mich.

FOR FASTER INSTALLATION
Specify and Install

Blackhawk Industries SNAP STRAP

for rigid and thinwall conduit

Patent Pending

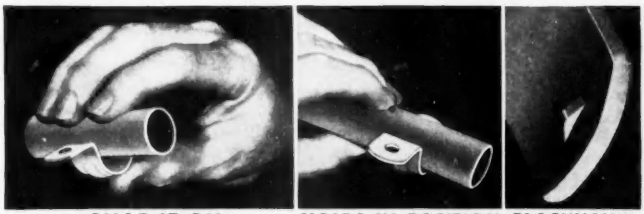


Exclusive self-holding feature saves time, eliminates fumbling and dropping, makes difficult installations easier.

Made of heavy gauge steel, zinc plated after fabrication. Wide range of sizes for rigid and thinwall conduit.

Ask for SNAP-STRAPS for all your conduit jobs.

Sold only through electrical wholesalers



SNAP IT ON HOLDS IN POSITION BLACKHAWK HAS IT

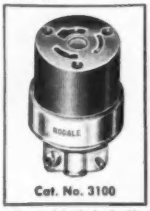
BLACKHAWK INDUSTRIES DUBUQUE, IOWA

Blackhawk Industries

Entrance Cable Fittings • Fluorescent Brackets • Staples
Cable and Conduit Straps • Yard Lights • Box Supports
Connectors • Wire Holders • Locknuts and Bushings
Sill Plates • Conduit Entrance Caps

"My Day as an Electrical Contractor" OR "IT ALWAYS PAYS— TO SAY RODALE"
—by Ed Campbell

"I've had occasion recently to use several of RODALE'S new TURN-TYTE *Interlocking Devices* and have found them to be just "as good as advertised." Not only are they precision-made . . . of the best materials . . . but they're INTERCHANGEABLE with similar devices. They lock with just a slight turn . . . and they're all UL.



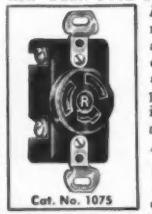
Cat. No. 3100

"For instance, the TURN-TYTE *3-Wire Cord Connector Body* worked out exceptionally well for a power fan wiring project I completed today. Consisting of two pieces of molded bakelite, it has an armored base and cord clamp. Bronze contacts mounted on brass terminals assure positive heat-free conductivity. Straps and armor are coated to resist rust and corrosion. Available in 10-15 amps and 20 amps.

"The same manufacturer also specified the new TURN-TYTE *Replacement 3-Wire Polarized Armored Cap*—with cord clamp for the extension cords of his air hammers. Made of bakelite and has brass blades and terminals. In 10-15 amps and 20 amps.

Cat. No. 1036

"And only this afternoon, for a printing press installation, I used the new TURN-TYTE *Polarized Single Receptacle*. It's molded bakelite and accommodates all standard single outlet plates. Available in 10-15 amps and 20 amps.


Cat. No. 1075

"How about YOU? Are you enjoying the safety, economy and dependability of RODALE'S TURN-TYTE Interlocking Devices? For catalog and complete details, write Dept. ECM-7."

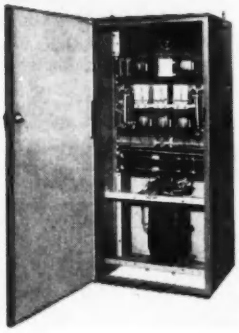
If your jobber can't supply you with TURN-TYTE devices, we will be pleased to send you a list of suppliers in your area.

RODALE
MANUFACTURING CO., INC.
EMMAUS PENNSYLVANIA

Magnetic Starter (25)

Announcement has been made of new ac combination magnetic starters, non-reversing with air circuit breaker for across-the-line starting. For full-voltage, non-reversing starting and overload protection of squirrel-cage motors and primary switches for wound-rotor induction motors. Starters are equipped with a 3-pole air circuit breaker. It is combined with a magnetic across-the-line starter, thermal overload relays and pilot-circuit holding contacts for use with "start-stop" pushbutton controls. Starters provide low-voltage and overload protection when used with "start-stop" controls. When used with a 2-wire pilot circuit device, such as a float switch, low-voltage release is obtained.

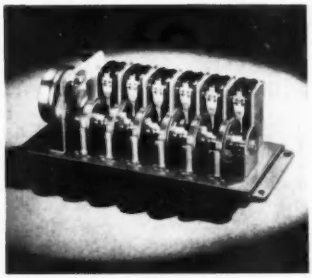
Euclid Electric and Mfg. Co., Madison, Ohio



Exciter (26)

Announcement has been made of a new development in connection with the "Regulex" rotating amplifier-type generator voltage regulator—the voltage measuring and control panel which has no moving parts or electron tubes. This static regulating equipment is built in standardized panel sections which can be mounted either in a cubicle or in switchgear units. It consists of a compensating unit for reactive current division, stabilizer panel, static voltage measuring circuit, a battery excitation switch and resistor, and a damping transformer assembly mounted from top to bottom in the cubicle. A knob on the front of the reactive compensating units adjusts the auto-transformer, while reactors and other units are mounted on the rear of the panel.

Allis-Chalmers, Milwaukee, Wis.



Timer (27)

A new type multi-cam recycling timer for industrial applications has been developed. A group of cams, operating snap-action switches, is mounted on a single shaft driven by a synchronous motor. All cams rotate simultaneously, and continuously repeat a constant time cycle that is common to all circuits. Each cam is independently adjustable for on and off electrical periods, and time cycles can be varied by substituting different size intermediate gears in the drive. Nine models are available, with time cycles ranging from 1 revolution in 40 seconds to 1 revolution in 72 hours.

Industrial Timer Corporation, 117 Edison Place, Newark 5, N. J.

Bearings and Bushings (28)

A new line of graphited oil-less bronze bearings and bushings, known as "Gopi", has been introduced. "Gopi" has reference to graphited, oil-less, pressure and impregnated. They are installed in remote and inaccessible locations; where fluid lubricants would contaminate work in process; where high temperatures would oxidize oil; where oil films would rupture under heavy static loads; where bearings are immersed in liquids; or where machines must be made as immune as possible to carelessness and neglect.

Bronze Bearings, Inc., 478 North Ave. East Cranford, N. J.

Doorway to opportunity for you

GENERAL ELECTRIC'S Home Light-Conditioning Program is underway in a *big* way! Aimed at improving the standards of home lighting, the program is built around a set of Light-Conditioning recipes which show exactly what lamps and fixtures to use and where to use them.

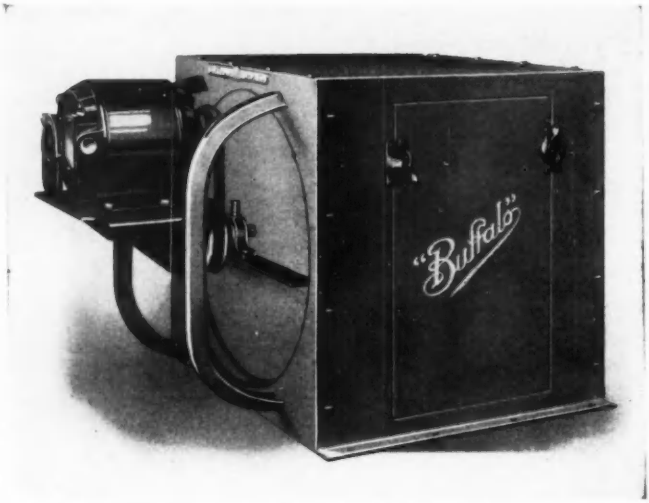
Already nearly 100 electric service companies are tying in with the program. Approximately 2 million recipe books have been distributed, and millions of people have been reading General Electric's national ad campaign on Light-Conditioning. The opportunities for *you* in Light-Conditioning are now opening up fast.

Light-Conditioning broadens your market for better lighting—particularly in lower-priced homes. It makes it possible for you to give your customers the right lighting for every room in the house—gives you sound reasons for recommending that the homes you wire have the right number and kind of outlets and fixtures. And since Light-Conditioning is basically for conserving eyesight and bettering the comfort of people's homes it offers an opportunity for prestige, publicity, and goodwill in your community.

For full information on the Light Conditioning Program—and how you can tie in—get in touch with your electric service company or write Lamp Department, Division 166-EC-6, General Electric Company, Nela Park, Cleveland 12, Ohio.

You can put your confidence in—

GENERAL ELECTRIC

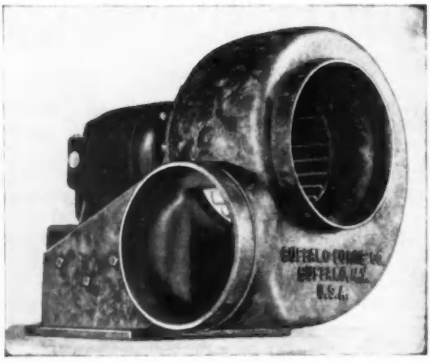


"L" BREEZO—Enclosed Exhaust Unit with Motor Removed From Air Stream

STURDY— EASY TO INSTALL —VERSATILE

"Buffalo" DISK FANS

The "Buffalo" line of disk fans are in real demand for a *wide range* of commercial and industrial ventilation applications! Take the "Buffalo" L Breezo above—it is an ideal package unit for exhausting gas, moisture, steam, smoke. Sizes 12" to 36" for as high as 7300 cfm. at ½" static. WRITE FOR BULLETIN 3222-F, and prices.



BABY VENT SETS

The truly versatile fans, these rugged units with cast iron housings and efficient multi-blade rotors can fit in almost anywhere for duct-mounted or free air delivery. For blowing or exhausting. Discharge position is adjustable and rotation direction reversible. Giving highly satisfactory service exhausting smoke, odors, gas, moistures, etc., from small areas. A fast seller. Write for Bulletin 3720 TODAY!

First For Fans

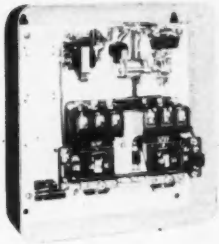
BUFFALO FORGE COMPANY

520 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in All Principal Cities

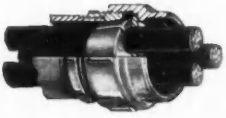
PANEL BREEZO FANS BELTED VENT SETS BELT-AIR FANS
BREEZ-AIR ATTIC FANS "L" BREEZO FANS "NV" BREEZO FANS



Control (29)

Announcement has been made of a new laundry washer control panel, Bulletin 723, for use with squirrel-cage motors driving washing machines used by laundries and dry cleaners. Washers consist of a large cylinder rotating in a shell containing water or cleaning fluid. To prevent snarling and tangling of clothes, the washer cylinder is operated in one direction for a certain lenght of time, then reversed and rotated in the opposite direction for the same length of time. A dwell period is provided between the reversals of the machine. Panels provide four reversals per minute with an adjustable dwell period. Panels are supplied for two wire control, operated from a maintained contact pushbutton, or three wire control, used with a momentary contact pushbutton.

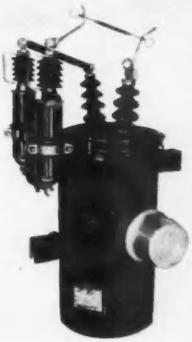
Allen-Bradley Company, Milwaukee, Wis.



Cable Support (30)

A new type of vertical cable support engineered to provide for an extension of rigid conduit or flexible conduit has been introduced. A typical installation would support the cables as they rise vertically in rigid conduit, and before they are continued in flexible conduit to some large rotating machine. The design of the fitting locks the wedging inserts into position. Known as type CSREF, it is part of a series of new fittings. This series includes a cable support, known as type SCSR, that enables the cables to be rigidly clamped and supported, and at the same time provides a terminal end to be sealed with compound.

The Adalet Manufacturing Co., 14300 Lorain Ave., Cleveland 11, Ohio



Voltage Regulator **(31)**

Announcement has been made of a new single-step voltage regulator, particularly adapted to rural distribution lines where it may be cascaded with minimum inter-reaction to bring voltage within tolerable limits. It provides a flexible means for correcting voltage drop as required along the distribution line. Features are light weight; minimum of moving parts; and quick-change sub-assemblies. It is controlled by an over-damped contact-making voltmeter, indicating as well as contact-making, and a time integrated delay built into its switching drive. It is pole mounted, O.I.S.C., 20 amperes normal, 40 amperes for four-hour peak. On 7200 and 7620 volt 60 cycle grounded systems, it will regulate 300 kva. single phase.

Rural Transformer & Equipment Co., 632 North 8th St., Milwaukee, 3, Wis.

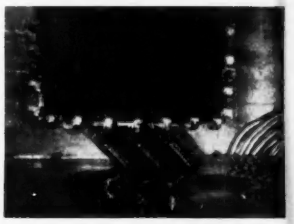
Outdoor Lantern **(32)**

Announcement has been made of the addition of an Alabax porcelain outdoor lantern to this line of lighting fixtures. It is easily cleaned and will not rust or discolor, or streak wall surface underneath. Available in black glaze, AL-2604, or brown glaze, AL-2605. Clear glass shade has enclosed bottom.

Pass & Seymour, Inc., Syracuse 9, N. Y.

Undersea wiring failures stopped with plastic tape!

Proof that plastic tape protects ➡



In the installation shown at right, transition splices between lead and rubber covered cables, subjected to corrosive action of salt water in a manhole below high-tide level, are still in perfect condition. This tough job at San Francisco Naval Shipyard is completely protected by watertight splices made exclusively with "SCOTCH" No. 33 plastic and No. 24 Neoprene Electrical Tape and "3M" Adhesive No. EC-847. Cables have been in service more than 18 months and show no signs of deterioration.

Whatever your insulating problem one of the many "SCOTCH" Brand Electrical Tapes can help you. They are easy to apply. Seal snugly around odd shapes and uneven surfaces. Write Dept. E C 651 for full information.

QUICK FACTS ABOUT "SCOTCH" No. 33 Electrical Tape

- **TOUGH PLASTIC**—is abrasion resistant, unaffected by water, oil, alkalies, alcohols, sunlight.
- **HIGH DIELECTRIC**—10,000 volts.
- **THIN CALIPER**—only .007 inch thick.
- **STRETCHY**—moulds to any surface.
- **NON-CORROSIVE**—contains no sulphur-bearing compounds.
- **P. S.**—for permanent high-heat insulation try "SCOTCH" Electrical Tape No. 27 with glass-cloth backing, thermosetting adhesive.

SCOTCH BRAND Electrical Tape No. 33

The term "SCOTCH" and the plaid design are registered trade marks for the more than 100 adhesive tapes made in U. S. A. by MINNESOTA MINING & MFG. CO., St. Paul 6, Minn., also makers of "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-Slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: Minn. Mining & Mfg. Co., International Division, 270 Park Avenue, New York 17, N.Y.

LATROBE

FLOOR BOXES — WIRING SPECIALTIES

PRODUCTS

QUALITY THAT LASTS

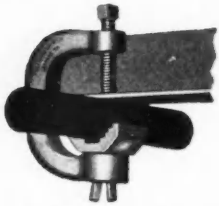
Quickly Installed
Efficient in Operation

There is nothing complex or intricate about "Latrobe" Floor Boxes and Wiring Specialties. Their design and mechanism is kept simple and sure. That is why "Latrobe products are so quick to install and so trouble-free in operation.

Sold only Thru Wholesalers

No. 252-R Two Gang Adjustable Floor Box

Neat and practical with No. 208 Receptacle in one section. One Cover Plate has ½" flush brass plug; other has 2".



No. 470 "Bull Dog" Pipe or Conduit Hanger

Convenient and dependable for hanging pipe or conduit ½", ¾" and 1" to steel beams up to ⅜" thick. Permits pipe to run at any angle to the beam.

No. 280 Nozzle with No. 200 Plate

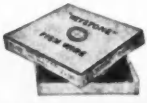
Has 10 Amp. 250 Volt Receptacle in Brass Housing, mounted on ½" Brass Pipe Extension 3" long. Longer extension if desired.

No. 330 "Tom Thumb" Utility Outlet

Ideal for use in wood floors, baseboards and other installations free from moisture or mechanical injury. Quick and easy to install.

Keystone Fish Wire

Finest grade flat steel wire in ten sizes. 100, 150 and 200 foot coils.



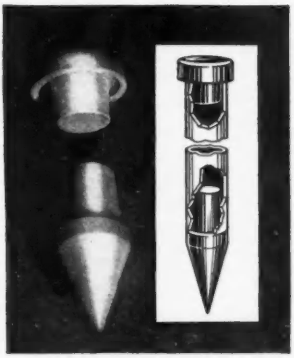
BX Cable Staples

Millions in use all over the country. Packed in cartons, kegs or barrels.

EASILY INSTALLED

FULLMAN MANUFACTURING CO. LATROBE, PA.

ECO-NOMICAL



Fittings (33)

Announcement has been made of two new fittings, ground pipe point and pipe cap. The first of these is a conical wedge which penetrates any normal type of ground. The latter is a cover used as the striking surface at the top of the pipe and protecting the pipe from flanging and other damage. They are designed to fit ¾ inch conduit or water pipe, and both fittings are made of malleable iron.

Gedney Electric Co., RKO Building, New York 20, N. Y.

Marquee Servicer (34)

Announcement has been made of a new Hi-Lift marquee servicer made to reach a 22-foot ceiling. Comes in one piece with no erection required. It is easily rolled and raised. Small enough to pass through any ordinary doorway. It has all welded steel construction and outrigger brace prevents tilting or rolling. It is recommended for overhead maintenance, painting, lighting, cleaning, etc.

Atlas Industrial Corp., 849-39th Street, Brooklyn 32, N. Y.

Electric Heater (35)

A new line of floor-model electric home-heating units that use the double-action heating principle is available. Heating is by continuous circulation of warm air and by radiation of infra-red rays. Two, three and four kilo-watt ratings are available, with respective heat outputs of 6830, 10,245 and 13,660 Btu/hr. All models operate from 220/240-volt polarized outlets. Room-by-room temperature regulation is maintained automatically by a built-in thermostat with Adjust-o-matic control.

Westinghouse Electric Corporation, Sunnyvale, Calif.

Solenoid Housing (36)

A new explosion-proof solenoid housing for use on Ross electrically operated pilot controlled valves has been announced. The cover, which can be used wherever fire and explosion hazards exist, is manufactured of cast-aluminum to Underwriters' specifications, Class I, Group D, Air Break Type. Provision is made for standard conduit connection. The explosion-proof solenoid cover may be used with ¼ inch to 1¼ inch size Ross pilot operated straight-way, three-way, four-way and four-way five port models for single solenoid operation. This housing may also be used for double solenoid, momentary operation of Ross base mounted pilot controlled valves.

Ross Operating Valve Company, 120 East Golden Gate, Detroit 3, Mich.

Relay (37)

Announcement has been made of a new relay, Type Em-7, which is a three pole relay employing one coil. Tungsten contacts are hermetically sealed in hydrogen-filled glass tubes. Three standard Ebert Type EMT tubes are used in one coil structure. This construction provides a contacting means for loads up to 35 amps at 115 volts ac, or 25 amps at 220 volts ac per contact. Relays can be supplied with all three contacts either normally open or normally closed or with any combination of normally open and normally closed contacts. Dimensions of relay are 4-$\frac{1}{16}$ inches wide, 5-$\frac{3}{8}$ inches tall by 3 inches deep.

Ebert Electronics Company, 185-09 Jamaica Avenue, Hollis 7, L.I. N. Y.

Product Briefs

(38) A modification in the **Garrison joint** design which triples the life of paper insulated power cable has been announced by The Okonite Company, Passaic, N. J.

(39) Westinghouse Electric Corp., Boston, Mass., has announced the addition of an eight-ton self-contained **air conditioner** to its Unitaire line. . . . (40) A new **terminal block,** originally developed for the Navy, is now available to manufacturers from Shaw Insulator Company, Irvington, N. J. . . . (41) Thompson Electric Company, Cleveland, Ohio, has announced the availability of a new line of corrosion resistant **pulleys.**

(42) Micro-Products Engineering Company, Newark, N. J. is producing

No wonder the big trend's to

AMPLEX SWIVELITES

Swivelite Hood units in Mace Jones Furniture Store, Kansas City, Kansas, supplied by W. T. Foley Electrical Supply Co., Inc.; lighting layout by John Maultsby, Architect.

THE PLAIN FACT is that Amplex Swivelites give the most for your money. They're smartest-designed . . . and made of aluminum with a permanent satin finish.

Special air-flow ventilation reduces burn-outs. Their exclusive double-ball swivel gives instant, positive, fingertip control. And each basic unit of Amplex Swivelites is interchangeable with every other. Arranging new lighting effects is faster, easier, more economical.

For today's outstanding buy, send for the complete Amplex Swivelite story!

Simply write Amplex Corporation, Dept. C-6, 111 Water Street, Brooklyn 1, New York.

AMPLEX

Sealed-Beam Reflector Lamps, Colorbeam Lamps, Spotlites and Floodlites, Industrial Infra-Red Heat Lamps, Vibration and Rough Service Lamps, Street Lighting Lamps, Traffic Signal Lamps, Incandescent Lamps, Fluorescent Tubes, Display Accessories.

Peerless-Electric

PRESSURE BLOWERS

FOR SMALL EXHAUST SYSTEMS AND FOR CONVEYING, COOLING, ETC.

PRODUCE A LARGE VOLUME OF AIR AT HIGH STATIC PRESSURES

● **Peerless Electric pressure blowers are designed to produce a large volume of air at high static pressures with the advantage of a self cleaning paddle wheel.**

These blowers are recommended for small exhaust systems where air is laden with dust or grit, and also for supplying high pressure air for conveying, cooling, etc.

The blowers are made in four sizes, with motors of 1/8, 1/3, 3/4 and 2 H. P., and wheels 7 3/4 x 2, 9 x 2 1/2, 10 5/8 x 2 1/2, and 12 1/2 x 2 1/2, respectively.

WHEELS — Constructed with straight radial blades supported on a heavy back plate with heavy cast-iron hub, dynamically balanced and designed for efficient operation.

HOUSINGS — Arc-welded 16-gauge steel housings and motor bases for rigidity and long life.

MOTORS — Standard blowers furnished with single phase Capacitor-Induction type or three phase Induction motors. All are equipped with ball bearing, rigid mounted motors. Also available in other current characteristics for special applications.

ROTATION and DISCHARGE—Furnished for clockwise rotation, bottom horizontal discharge unless otherwise specified. At time of installation housings or wheels may be turned for other discharges and rotation if so desired.

CAPACITIES —Tested and rated in accordance with codes adopted by National Association of Fan Manufacturers and the American Society of Heating and Ventilating Engineers.

GUARANTEE — Units are guaranteed against defective workmanship or material for a period of one year from date of shipment from factory. Each unit when shipped is registered and the serial number identifies it immediately for spare parts or duplicates.

Write for sheet giving complete specifications and prices.

THE PEERLESS ELECTRIC COMPANY

Established 1893 • WARREN, OHIO

Peerless-Electric

MOTORS • FANS • BLOWERS

"Quadri-Coat" for soldering iron tips. . . . (43) Robot Appliances, Inc., Dearborn, Mich. has introduced a new **"Robot" operator** for rotating an antenna. . . . (44) Allied Tools, Inc., Newark, N. J. has introduced the Kango **electric hammer** line in this country.

(45) Newage International, Inc., New York, N. Y., has announced that the Desoutter **drill gun** has been geared down to 450 rpm for high tensile steel. . . . (46) A new and improved **pilot light** known as the Omni-Glow has been announced by Industrial Devices, Inc., Edgewarter, N. J. . . . (47) A redesigned line of light capacity electric fork lift **trucks** has been announced by the Philadelphia Division, Yale & Towne Manufacturing Company.

(48) A new line of Black-Ray **ultra-violet lamps** for observing fluorescence has been announced by Ultra-Violet Products, Inc., South Pasadena, Calif. . . . (49) U-C Lite Manufacturing Company, Chicago, Ill. has designed a new Big Beam portable **electric hand lamp**. . . . (50) a new model Dustkop **dust collector**, especially intended for use where remotely located dust sources have toxic fumes, vapors or obnoxious odors has ben announced by Aget-Detroit Co., Ann Arbor, Mich.

(51) A new **ladder stabilizer**, known as Hydra-Lizer, is an adjustable steel attachment for the lower end of straight or extension ladders. Manufactured by Mine Safety Appliances Co., Pittsburgh, Pa. . . . (52) Wasserlein Mfg. Co., Inc., Joliet, Ill., has announced a panel accessory for the Glo-Melt **soldering equipment**. . . . (53) Syntron Company, Homer City, Pa., has developed a new **vacuum cleaner** for industrial use.

(54) A new 4 hp gasoline chain **saw** has been announced by Homelite Corporation, Port Chester, N. Y. . . . (55) Kepco Laboratories, Inc., Flushing, N. Y. has introduced a new 600 volt regulated **power supply**. . . . (56) A new portable **power saw and file** named E-Z Saw has been introduced by E-Z Way Tool Co., Chicago, Ill.

(57) A new miniaturized indicating **fuseholder** that spots blown fuse has been announced by Alden Products Company, Brockton, Mass. . . . (58) Cornell-Dubilier Electric Corp., South Plainfield, N. J. has announced a new pole mounting 225 Kvar switched power factor improvement **capacitor bank**.

(59) The Patent Scaffolding Co., Inc., Chicago, Ill. has introduced two new types of aluminum **scaffolds**; sectional rolling scaffolds and sectional ladder scaffolds.

CATALOGS and BULLETINS

(60) LOAD CENTERS and service equipment permitting future expansion for residential and small commercial establishments are presented in bulletin 204. Frank Adam Electric Co.

(61) MOTOR REPAIR shop equipment, including coil tamping tools and wedge drivers, growlers, insulation formers, armature holders and coil winder drives and heads is pictured, priced and described in 2-color booklet published by Crown Industrial Products Co.

(62) DRIVES for pulp mills are contained in 8-page bulletin GEA 5520 describing saws, chippers, grinders, washers, pumps, material handlers and such. General Electric Co.

(63) SHELVING method, using uniclips, steel channels, variety of connecting fittings and wooden sheles, is fully discussed in bulletin UC-1 issued by Unistrut Products Co.

(64) INSULATING varnishes and varnished insulation is subject of 52-page booklet including data and discussion on tubing, plastics, filling compounds, slot and varnished insulations. Irvington Varnish and Insulator Co.

(65) MOTOR CONTROL 92-page catalog features quick-reference index, new illustrations and complete up-to-date technical data. Allen-Bradley Co.

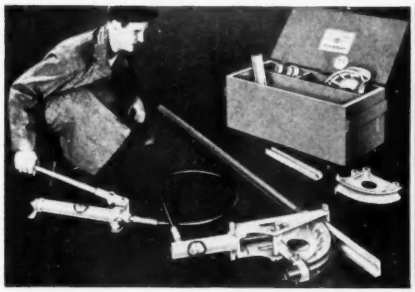
(66) POWER FACTOR visualizer SA-6739 that presents simple explanation of use of capacitors in solving low power factor problems and describes benefits to be obtained by such installations, is published by Westinghouse Electric Corp.

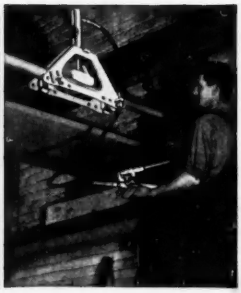
(67) INSTRUMENT TRANSFORMER buyer's guide with sections offering data on indoor and outdoor potential and current transformers, metering outfits, tests and tables is available. GEA 4626. General Electric Co.

(68) AIR CONDITIONING equipment such as cooling, heating, cleaning, filtering, circulating, dehumidifying or ventilating is listed and described in 16-page catalog SA-6692 published by Westinghouse Electric Corp.

(69) MOTORS, single- and polyphase from 1/6th- to 400-hp, are pictured in 4-page folder MU94. Wagner Electric Corp.

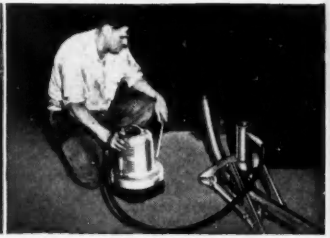
5 WAYS to slash costs on conduit installations





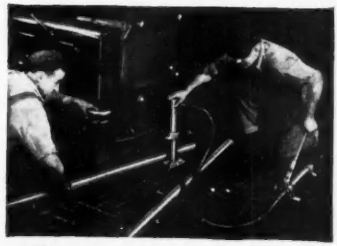
1 **Now, THIN WALL Conduit can be bent profitably!** This new bender (No. S-34) pays for itself on the first good job. Handles 1¼, 1½ and 2". Remotely-controlled "Porto-Power" hydraulic unit creates exclusive advantages and also serves rigid-pipe benders.

2 **More speed on RIGID Pipe, too!** Bend sizes from 1" to 4". The hydraulic ram works *at any angle* — overhead, on the floor or bench.



3 **Operate Knock-out Punches with HYDRAULIC power!** Save at least 60% of the job time. Punch holes up to 4½" with surprising ease. No wrench to swing!

4 **Eliminate hand pumping!** A motorized, portable pump (No. P-182) can triple the output of a pipe bender. It's spectacular on other hydraulic equipment, too!



5 **Lift machinery, pull-pulleys.** Dozens of allied jobs are licked by the "Porto-Power" hydraulic jacks which serve Blackhawk Electricians' equipment.

Savings in material costs and time are so large that it will pay you to get the full facts immediately on this low-cost equipment. Buy from leading supply houses.

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Milwaukee 1, Wis.

Rush free Catalog No. 50B on Blackhawk Electricians' Equipment.

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HYDRAULIC "Porto-Power" EQUIPMENT

"CERTAINLY

MAKE THE ORDER FOR QUAD" LIGHTING UNITS

ANGLE REFLECTORS FOR SIGNS

FLOODLIGHTS FOR AREA LIGHTING

POST TOP OR PUMP ISLAND RFLECTORS

Once the men who pay the bills have experience with QUAD REFLECTORS they are quick to o.k. Quad for new installations and replacements.

Because of wide customer favor for Quad it's profitable to stay with this line. You have ease of installation and dependability of performance.

You'll find the correct unit for most outdoor lighting requirements in this modern and complete line. You'll also find that these units are flexible in design, fully weatherproof, and that the porcelain finish is permanent.

Make Quadrangle your headquarters for your outdoor lighting units. Always consult the Quad catalog—it's most helpful.

Sold through electrical wholesalers.

QUADRANGLE MFG. CO.

325. PEORIA ST. CHICAGO 7, ILL.

(70) TESTING INSTRUMENTS buyer's guide with prices and description of hook-on volt-, ampere-, watt- and power-factor-meters, GEA 5469, is available from General Electric Corp.

(71) LUMINAIRE for industrial use, with either 2 or 4 fluorescent 4- or 8-foot lamps and perforated- or closed-top reflectors, is described in Convaire file folder by the Miller Co.

(72) CABLE JOINTS to resist fatigue and prolong sheath life are pictured and discussed in 4-page bulletin OK-1051. The Okonite Co.

(73) CONDUIT HANGERS for supporting single runs of conduit, using beam clamps, anchor clips, conduit straps, conduit hangers and ceiling flanges, are specified and priced in Specification B2. The Kindorf Co.

(74) ELECTRICAL TAPE for corrosion protection, spot repairing and fast applications is subject of 4-page brochure E-SPF 311 W. Minnesota Mining and Manufacturing Co.

(75) INSTRUMENTS and their use in everyday living is the theme of pocket-sized booklet discussing in non-technical terms the applications of instruments in television, aviation, refrigeration, illumination, etc. Weston Electrical Instrument Corp.

(76) SHOCK RESISTANCE and designs to reduce vibration is discussed and illustrated in 16-page file-sized presentation published by the Barry Corp.

(77) MATERIALS HANDLING by electric-power industrial trucks is subject of 4-page folder presented by the Elwell-Parker Electric Co.

(78) INDUSTRIAL LIGHTING with fluorescent, mercury and incandescent sources is discussed in terms of efficiency, color quality, lamp life, maintenance, mounting heights and job suitability in 16-page booklet B4727 released by the Westinghouse Electric Corp.

(79) PIPE AND BOLT tool operating guide, with discussion of common machine faults and their remedies, is released by Beaver Pipe Tools.

(80) AIR CONDITIONING self-contained units with ratings from 24- to 96-thousand cooling units, for use in shops, laboratories, restaurants and industrial locations are discussed in bulletin DB 102-205. Westinghouse Electric Corp.

(81) SLIMLINE LAMPS, their advantages, applications and construction features, are illustrated and discussed in 12-page bulletin 1b-192. General Electric Co.

(82) CO-ORDINATED MOTOR PROTECTION, combining interlinked circuits, combination starters and protective measures for operating personnel, is subject of booklet DB4673. Westinghouse Electric Corp.

(83) LIGHTING FIXTURES of convertible vaportight construction, with dimensional data, parts and accessories are subject of bulletin 5-A of Series V51. Appleton Electric Co.

(84) FLUORESCENT industrial fixtures using slimline lamps, depressible lamp holders and high-efficiency reflectors are subject of "Industri-Line" bulletin. Wheeler Reflector Co.

(85) SILICONE INSULATION materials are discussed in series of product bulletins, Numbers 250, 400, 511, 527, 680, 680A, 750 and, 800, describing flexible braided varnished or saturated glass tubing and sleeving, silicone treated glass type chords, bonded mica segment plates, plain mica and mica-glass sheets and tapes, flexible abrasion-resistant silastic tape, impregnating varnishes, silicone resin coated glass cloth and discussions of the five electrical insulation classes. Insulation Manufacturers Corp.

(86) HIGH-SPEED SAW for cutting plaster walls, metal sheets, pipe, wood or Transite is subject of 4-page pocket-sized brochure containing illustrations and prices. Tri-Saw Corp.

(87) TOOLS and products for reducing maintenance, construction and production costs, including flexible abrasives, commutator resurfacers, grinders, undercutters, slotting files, wire strippers, insulation testers, wire nuts and set screws, blowers and etchers, are described in multi-fold mailing piece. Ideal Industries, Inc.

(88) SPEED REDUCTION is subject of bulletins A470 and A602 that discuss selection of shaft-mounted speed reducers, factors in selecting sheaves and drive belts and data on various mechanisms. Dodge Manufacturing Corp.

(89) UNIT AIR CONDITIONERS for home, office, factory or small shop are pictured, discussed and analysed in 12-page bulletin B-5158. Westinghouse Electric Corp.

(90) PUMP CONTROLS where 2 or more pumps are used in pressure tank systems are discussed with installation diagrams, specifications and performance data in 4-page bulletin 1510. Automatic Control Co.

Here's the greatest
TIME-SAVING
MONEY-SAVING
fastening team in history!

for Split-second Fastening of steel or wood to concrete, steel, masonry

With the introduction of the new heavy-duty "400", DRIVE-IT now offers the best engineered fastening team in the history of powder-powered tools.

Time-tested, exclusive features of the popular DRIVE-IT "300" have now been embodied in the new heavy-duty "400". These include CONTROLLED POWER with one power load, PERMANENT, ADJUSTABLE safety pad, SURFACE PROTECTOR to prevent splitting wood and 25% greater driving power.

So on all jobs involving the anchorage of steel or wood to concrete, steel or masonry, let the DRIVE-IT "fastening team" save you time and money. Write for the name of your DRIVE-IT representative.

Distributors Coast to Coast
THE POWDER POWER TOOL CORPORATION
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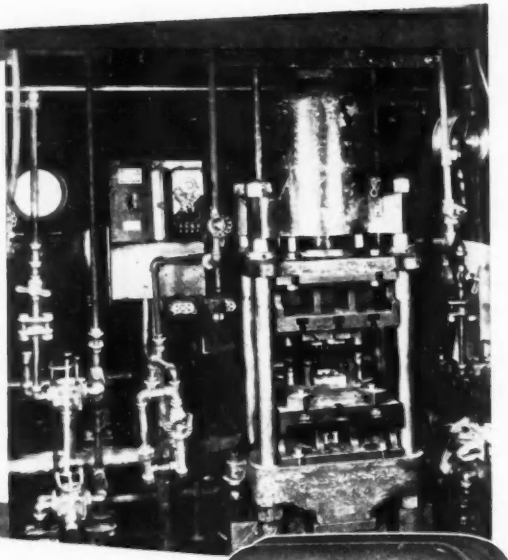
(Canadian Distributor:) Ammo Power Tool Co., Ltd.
Foot of McLean Drive, Vancouver, B. C.

SANGAMO

the time switch with the *Automatic Memory*

will help eliminate costly manual operations in

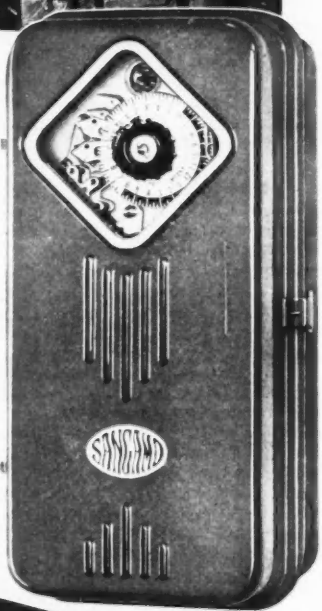
INDUSTRIAL PLANTS



Reliance on manual pushbutton operation of important circuits in industrial plants often results in costly inconveniences. When properly selected for a specific application, Sangamo Time Switches completely eliminate any need for manual operation. The automatic memory of these switches can be absolutely depended upon to perform repetitive control functions—such as operating power circuits before a workshift begins or after it ends, or to control factory yard flood lights—at *exactly* the right time. Below is a list of suggestions as to where Sangamo Time Switches can serve in industrial plants.

ABOVE:

Plastic molding press heaters are brought up to operating temperature before working hours by the Sangamo Heavy Duty Time Switch on panel in background.



AT RIGHT:

Sangamo Heavy Duty Time Switches are available in a wide range of types for industry. They provide an *extra* margin of dependability at only slightly higher cost.

INDUSTRIAL APPLICATIONS

For daily pre-heating:

- Lead pots for solder operations.
- Zinc for injection molding.
- Type metal in type foundries.
- Dies in plastic molding presses.
- Glue in woodworking shops.
- Tanks for galvanize dipping.
- Electric ovens and furnaces.
- Infra-red paint dryers.
- Electronic testing equipment.
- Soldering irons on assembly lines.

For daily circuit control:

- Yard floodlights.
- Runway and hall lights.
- Electric factory signs.
- Pumps, compressors.
- Water softeners.
- Mixing equipment.
- Electric doors and gates.
- Air conditioning.
- Alarm systems.
- Exhaust fans.
- Electric valves.
- Two-level thermostats.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

Get the full story—write for Catalog No. 1010-A today.

SANGAMO

ST51-5

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Reader's Quiz

Motor Winding

QUESTION Y-17—At our plant we connected a ¾ hp, 3 phase, 220/440 volt motor to a reversible starter. Line voltage at 440 motor was wound 2 parallel star.

When the motor was started under partial load, it had about 50% or less its starting torque in one direction. In the opposite direction, it would start only by removing all of the load.

After disassembling and examining the winding, it was discovered that 2 opens were in the 2-5 leg of the winding. The growler indicated several shorts, throughout the stator.

Why should this motor have this peculiar behavior—more torque in one direction than the other?—C.L.S.

ANSWER to Y-17—Behavior of your motor was caused by difference in loading while running in different directions. Slight variation in load produced enough additional torque to stop your motor cold.

Similar conditions may be also produced by high resistance path in transfer switch caused by loose contacts and overheating.—W.J.P.

ANSWER to Y-17—Controllers sometimes have good contacts in one direction but not in the other direction. The load may be different in each direction. The shorts and opens may show up in one direction only.—H.S.

Capacitors

QUESTION A-18—The use of capacitors has increased to enormous proportions among rural cooperatives in this region of ample TVA hydro power and with them have come problems quite new to rural line engineering.

Many of the roads are as crooked as the proverbial dog's hindleg and are none too wide nor well marked, hence our outages chargeable to collisions are many. With delta connected capacitors in a four wire wye system, we are really "sitting ducks" for the occasion when a phase fault may cause serious resonant overvoltage with most damaging results to the connected load; primarily lamps and motors.

The hot stove league debate has it that should a single phase failure occur, the intact phase would have a transformer and capacitor in series between it and the neutral. With a second wire open, the single remaining line would energize both since the aforementioned series arrangement of transformer primary and capacitor bank would be established on the normally "dead" phase.

When this occurs, things happen as evidenced by a recent failure far out on the extremity of a line that brought the signal men of the L & N Ry. Co. out on the next train. TVA alternating current was flowing in the rails in such volume as to completely upset the train signal system.

The answer appears to be not too remote. The idea is to connect the capacitors in wye and to tie its junction to the neutral.

Any comment, readers?—P.C.Z.

ANSWER to A-18—Your system will stop the shock hazard caused by power flowing through the capacitors from the remaining live line. The only protection that will work is a magnetic switch that will allow the capacitors to be connected when the load is 10% above the kva. rating of the capacitors. The Line Material Company described a system in the March 1941 issue of E. C. & M., page 101, that operates on voltage changes.—H.S.

ANSWER to A-18—To make a comment of any great value, one would have to be throughly familiar with both the particular electrical power system and the particular railroad signal system referred to in the question, and also the distances between them or at least see drawings of both systems and distances and relative location of both systems. If the trouble only occurred once, it may be just a coincidence. If it really occurred every time and reconnecting the capacitors from delta to "Y" connected the trouble then your diagnosis is correct, it would appear that the signal relays would have to be very sensitive to operate from any current due to radio effect and there would have to be a tuned circuit to pick effect up. If the rails are grounded and the neutral is grounded and the power system is located close by along the length of the railroad, power neutral current would divide inversely in proportion to the impedances of neutral conductor, tracks and earth.

Connecting the capacitors in "Y" would tend to localize any troubles to particular phase on which they occurred. Since the amount of lagging current compensated for by the condensers depends upon their size in farads and the voltage across them they should compensate for less lagging current when connected "Y" than when connected "◀". This would decrease the possibility of over voltage. —E. B.

Charging Current

QUESTION C-18—When placing the fuses in the fuse blocks of a branch circuit, (550-440 or 220v. 3 phase) with no load on the circuit, I notice a slight arc between the fuse and fuse-block contacts when placing the second and third fuses in. What causes this arc?—A.R.

ANSWER to C-18—That arc observed when the final fuses are inserted in an energized circuit is caused by a combination of leakage current and capacitive charging current.

Leakage current is a small current which always flows in an energized circuit. It is current which sneaks across dirt that collects between exposed terminal posts on switches and fixtures, seeps through moist insulation, or slips around poorly taped spliced connections. No insulation is perfect, and leakage current passes between conductors in the same manner that water seeps out at couplings, unions, and gaskets in a piping system.

Charging current is a second small current which flows in energized conductors, even when no load is present. the two conductors form the plates of a makeshift condenser, the insulation and air separating them forms the dielectric, and, as in any other condenser energized with alternating current, there will be a current flow that varies with the voltage and capacitance.

Which of these two factors lies behind the arc observed depends upon many local conditions. In a poorly insulated, damp line with dirty insulators, leakage is doubtless responsible; on long, closely spaced, high voltage circuits the capacitive effect probably predominates. Such current flow is normal, however, and unless excessive, will do no harm.—D.H.N.

SOMETHING NEW IN OUTLET BOXES

Pat. applied for

Catalog No. 9-OX, 4" octagon, bevel corner outlet box, 1½" deep, for non-metallic sheathed cable. Readily accommodates cable coming in from back or side.

Write for Information and Prices

The M. B. Austin Company
NORTHBROOK, ILLINOIS

magno-tronic

DUAL SILVER POINT — FULLY AUTOMATIC

FLUORESCENT STARTERS

—completely eliminate annoying blinking and flickering of dead fluorescent lamps!

GUARANTEED — FOR ONE YEAR!

This is a glow switch condenserless precision starter equipped with automatic thermal relay circuit breaker. The relay automatically removes the lamp from the circuit electrically when the lamp becomes de-activated and automatically resets upon interruption of the lamp circuit.

SIMPLIFIES — Replacement of defective lamp automatically recycles starter circuit. No buttons to push — no replacement of starter.

REDUCES COST — Magno-Tronic starters provided exact timing of electrode heating, preventing excessive loss of emission material, thus assuring maximum possible lamp life.

VERSATILE — Built to operate efficiently over an extended voltage and temperature range.

SP-15-20 For use with 15 or 20 watt lamps.

SP-30-40 For use with 30 or 40 watt lamps.

SP-85-100 For use with 100 watt lamps.

Manufactured under U. S. PATENTS

2298236 2159837 2339307
2334935 2239244 2333694
2341520 1849552

Other Patents Pending

INDUSTRIAL ELECTRONICS CORP.
General Offices & Main Plant, 80 BANK STREET, NEWARK 2, N. J.

ANSWER to C-18—A. R. is noticing the effect of a "charging current".

The circuit wires form a condenser or capacitor. Actual capacity depends upon the length of circuit, wire spacing, wire diameter, arrangement of conductors, and presence of neighboring metallic materials such as cable-sheath, conduit, building members, etc. Formulas and examples are given in handbooks for electrical engineers.

The arcs are caused by the current placing a charge between the conductors. The value of the current could be computed if the circuit constants were known. However, in most circuits encountered in building wiring, the steady-state value is quite small. The initial inrush of the charging current is several times the steady-state value, depending upon the circuit constants, but drops off in a fraction of a cycle.

An element of time is required to build up the charge. As the charge increases, the charging current decreases.—L.E.B.

ANSWER to C-18—I have noticed this same phenomenon when after hooking up a new machine and placing the fuses in the clips before any load is connected and contribute it to condenser effect.

That is the line wires from the load side of the fuses to the contactor or control panel acting as plates of a condenser and upon placing the fuses in the clip the lines are being charged.

No arc would occur until the second fuse is inserted as this would connect to the second plate of the condenser. However, if the 2nd or 3rd fuse is in place and the first one be removed an arc will be noticed as one plate of the condenser is being removed.—E.E.M.

ANSWER to C-18—This arc you speak of is caused by the flow of a small amount of charging current into the circuit due to condenser action.

In long transmission lines, this current may be large enough to open the circuit breaker and it is sometimes necessary to put an induction load on the line to offset this charging current. —A.E.T.

Testing Ionodic Rod

QUESTION D-18—Is there any way to determine when an ionodic rod should be renewed in an electric water heater without removing it at intervals?—R.E.L.

ANSWER to D-18—Bring the rod terminal to the outside of the tank in order to get a chance to connect an

ammeter between the rod terminal and a terminal on the tank, instead of connecting the rod inside the tank. The ammeter reading is used as for testing batteries.—H.S.

ANSWER to D-18—General opinion is that the rod is good for 15 years or more in most kinds of water, because I believe it would have to become dissolved before it would be ineffective.

If the water started coming rusty at the hot water faucets, it would be an indication that a new rod was needed; otherwise, I doubt if there is any way to tell except to drain the water partly out of the tank, remove the plug which holds the rod and determine if the rod still exists.—M.C.T.

Identifying Terminals

QUESTION E-18—Three phase squirrel cage, star or delta connected motors, dual voltage, nine leads. (440-220 volt in particular.)

Is there a simple method of definitely identifying terminals, in case of error or loss of markings?

Without dismantling motor.

Without running motor.

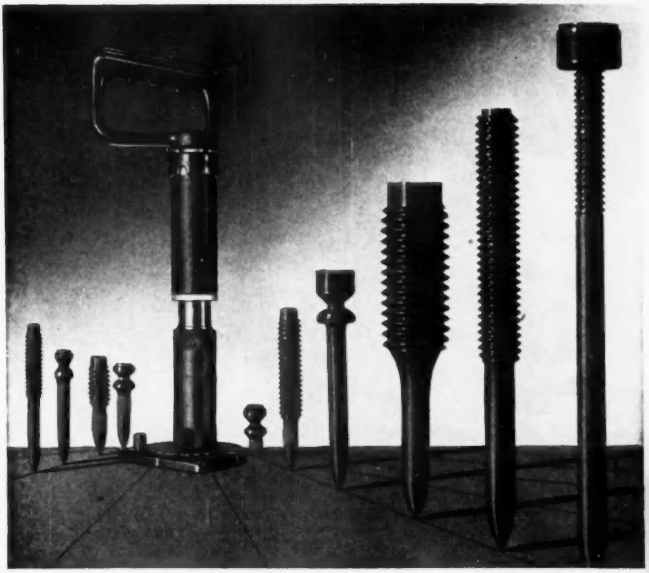
Without requiring a large power supply.

110 and 220 volt 60 cycle single phase, and 440 volt three phase available; but not 220 volt three phase.

Ammeter, voltmeter and ohmmeter available.—B.F.W.

ANSWERS to E-18—I believe you can work this out with a battery about 6 volts, and a common compass, include a rheostat or lamp in series also. Draw a diagram of the stator and mark in the momentary north and south pole sections as indicated by the compass as you energize different leads with the battery. Mark each lead, and indicate on the sketch which part of the stator it supplies. The 3rd phase will be the most confusing, but if you are familiar with ac three phase windings, it will be all right. After connecting the nine leads together, then test the complete motor with the battery, and compass to see that there are no cross-ups before applying the power to the motor. Also use ohmmeter test. When you first energize the motor, it would be best to right away check the amperage and voltage of all three phases, to see that everything is properly connected as a final check.—M.C.T.

ANSWER to E-18—We used the following simple way to identify leads for star connected motor which can be divided into three steps. Instruments needed—voltmeter and set of test lamps.



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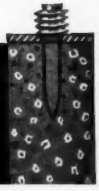

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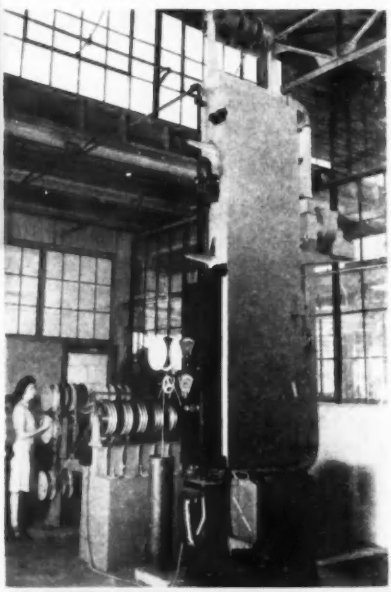

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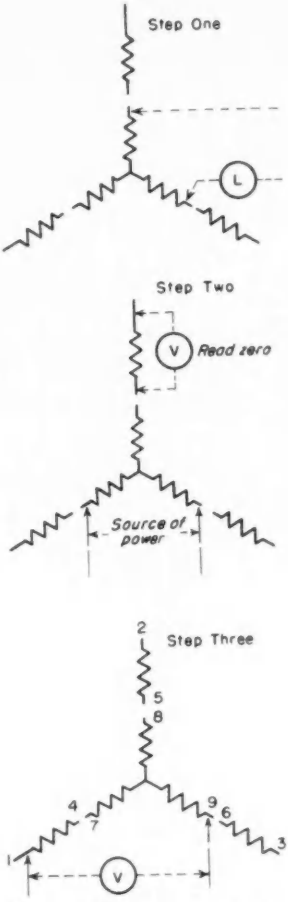


Step one—locate three leads forming star. Connect test lamp to **alternate** ends of wires until you find three connected together; they will give bright reading while the rest will be dark.

Step two—is taken to determine which leads belong to the same phase. Connect source of power at limited voltage to any two sides of "Y" and probe all remaining leads with test lamp or voltmeter. When lamp or voltmeter shows no indication you have the other phase, by repeating this procedure all phase leads can be found.

Step three—is necessary to determine ends of coils of the same phase to be connected together. Apply source of power at limited voltage as shown on sketch and take voltmeter reading with opposite ends of coils connected together. Low reading of voltmeter indicates proper connection. It may be necessary to use sensitive voltmeter for this part of experiment. Renumber leads with standard numbers as shown.—W.J.P.

Can you ANSWER these QUESTIONS?

QUESTION R18—I want to obtain about 64 volts and I have available a 110 volt supply and transformers rated 110 to 32 volt.

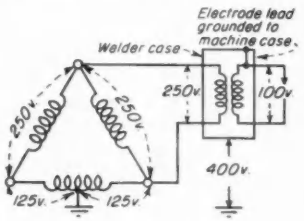
Would it be satisfactory to connect two of these together: the primaries in parallel on 110 volt and the secondaries in series? As I see it, the only precaution I would need to take is to see that the load current does not exceed the rating of the smallest transformer. —R.J.S.

QUESTION S18—How long will iron conduit in its passive state last in a cinder fill?—H.S.

QUESTION T18—What is meant by single phasing on a three phase system? How does this cause motor burnouts and how can it be avoided? —R.W.D.

QUESTION U18—I have a 500 amp single phase transformer type arc welder which is rated at 220 volts input and 75 volts open circuit output. This welder is connected to a 250 volt circuit and produces approximately 100 volts on the secondary or welding side. The electrode terminal or "hot side" is connected to the case of the machine. The case is not grounded.

It was discovered that approximately 400 volts existed between the case of



the machine and the electrical ground of the distribution system thus creating quite a hazard.

A continuity check showed no connection between either primary lead and the case or either secondary lead. The power supply to the welder is three phase, three wire delta with a grounded midtap on one phase. Voltage from input leads to ground measure 216 volts and 125 volts respectively.

The welder works ok. What and where is the cause for the 400 volts to ground?—E.A.E.

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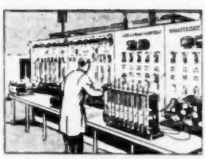
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Fire Underwriters Inspection Bureau
Minneapolis, Minn.

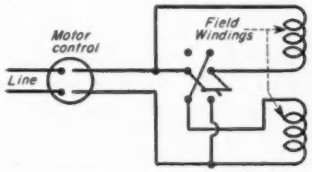
and

B. A. McDONALD
Chief Inspector
New York Board of Fire Underwriters
Rochester, N. Y.

Questions on the Code

Motor Connections

Q. *Concerning the Question and Answer given in a previous issue of this magazine, about a double-pole, double-throw-switch to run an induction motor on either 110 or 220 volts, would this sketch accomplish the desired result with a double-pole double-throw switch?*—J.F.M.



A. The double-throw switch as shown in the diagram is all right as far as it goes in taking care of the connections to the field windings but it does not accomplish the switching of the motor "line" from 110 to 220 volts or vice versa. Again, another double-throw switch is necessary. Our original arrangement took care of all connections in one double-throw operation.—F.N.M.S.

Transformer Vault

Q. *We are installing wiring in a rather large building in which a transformer vault will be located. Primaries will enter this vault at 13,800 volts and the transformers used will have a capacity of some 300 kva each and as they are oil filled we understand a vault must be erected about them. We would like if possible to place within this vault a power distribution panel on which the maximum voltage will be 240 volts. Will the Code require that an 8-inch or thicker masonry wall be erected between the transformers and this power panel if the panel is wholly enclosed within a standard masonry vault?—A.O.D.*

A. If unqualified persons will have access to this power panel, then the Code will require that some form of barrier be erected between the power panel and the transformers or any of the high voltage bus. This might be wire mesh on a metal frame with a locked door opening or gate through which properly qualified personnel would have access to the transformers and other high voltage equipment. It is assumed the enclosing vault itself will be constructed in accordance with the requirements found under Sections 4542 through 4547 of the National Electrical Code. —G.R.

Non-Metallic Cable In Masonry Wall

Q. *Is it permissible to run non-metallic sheathed cable from an outlet box, mounted in a pumice block wall, through conduit to top of wall without an outlet box on the upper end of conduit?—K.L.W.*

A. It appears from your question that the conduit is used to afford a raceway through the pumice wall from the outlet to the top of the wall. Section 3362 of the Code prohibits embedding the cable in masonry. The use of the conduit as you describe, in my opinion, however, eliminates a violation of this rule. Section 3364 of the Code recognizes the use of conduit to protect non-metallic sheathed cable from mechanical injury and when so used, an outlet box is not required at either end of the conduit. I believe the case you cite is similar and that it is not necessary to install an outlet box on the upper end of the conduit. I do believe, however, that a bushing should be installed at the end of the conduit.—*B.A.McD.*

Wiring A Dairy Barn

Q. *Why does not the National Electrical Code permit the use of conduit for the wiring of a dairy barn?*—P.E.

A. The National Electrical Code does not prohibit the use of conduit within a dairy barn. However, it is entirely possible that the power company serving the area in which you are interested does prohibit the use of conduit and we believe they have rather justifiable reasons for requiring nonmetallic wiring systems.

First, livestock is very susceptible to shock hazards and it is felt that a nonmetallic wiring system offers less likelihood of electrical shock to such livestock.

Second—The corrosive conditions in many dairy barns is quite severe, with the result that conduit and its boxes have a rather limited life. Therefore, wiring regulations for many rural areas specify that only nonmetallic wiring methods shall be employed utilizing nonmetallic surface wiring devices or outlet boxes and in some areas they also require that service equipment and distribution panels be located outside of the building or at least in separate areas in which livestock are not housed.—G.R.

20 Ampere Branch Circuits

Q. *What section or sections of the new Code allows the use of No. 12 wires fused for 20 amperes for lighting branch circuits in homes?—J.Y.M.*

A. Section 2123a of the 1947 Code required that lampholders when connected to circuits having a rating of 20 amperes and over shall be of the heavy duty type. An exception to this rule, 2123c-2, permitted medium base lampholders of the porcelain unswitched type and fluorescent lamps to be connected to 20 ampere branch circuits if only fixed lighting units were used. You will note that this rule prohibited the use of medium base lampholders and smaller, usually found in residential occupancies to be placed on a circuit protected by more than 15 amperes.

Section 2123a of the new 1951 Code is reworded so that lampholders when connected to circuits over 20 amperes, shall be of the heavy duty type. This new wording permits lampholders of medium base or smaller to be used on 20 ampere branch circuits.

Another change, concerning receptacles was necessary. The 1947 Code, Section 2123b required receptacles

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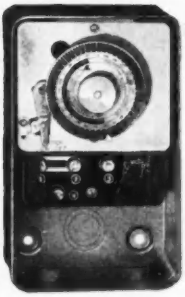

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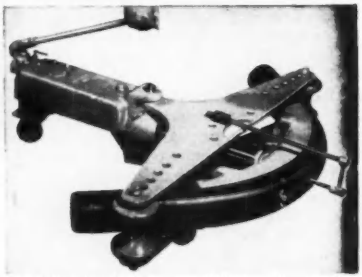

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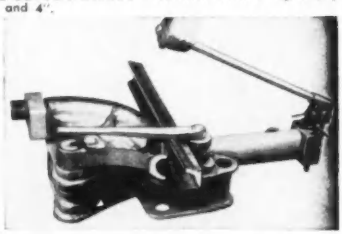

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used on a 20 ampere circuit to be rated at 20 amperes. The new 1951 Code, Section 2123b permits receptacles, either 15 or 20 amperes to be used on 20 ampere circuits.

These two apparently small but significant changes in the Code permits us to use 20 ampere branch circuits in residential or any other type occupancies.—B.A.McD.

Lightning Protection And Aluminum Siding

Q. *In the remodeling of old farm dwellings in this local rural area, aluminum siding is being used quite extensively and the question in mind, is, how do we attach the lightning rod grounding, to this siding?*

Should we use stand-off insulating brackets or all metal brackets and ground the siding?

We have no electrical inspection in this county and being in business and also a volunteer fireman, I am striving at all times, to promote proper wiring, as recommended by the National Electrical Code and also to promote fire safety. What do you suggest in the above case?—A.J.G.

A. The aluminum siding should be connected to the grounded conductor of the lightning protection system, but the grounding conductor, which can be in direct contact with the aluminum siding, would also have to be of aluminum in order not to have dissimilar metals in contact with each other. Dissimilar metals in contact with each other and in the presence of moisture, would cause undue corrosion, as well as other possible troubles.

Aluminum grounding conductor cables for use in connection with lightning rod systems, have been approved for this purpose.—F.X.M.S.

Emergency Lighting In Hospitals

Q. *Is there any provision in the N. E. Code that requires the installation of emergency lighting in a hospital to provide exit signs and stairway and passageway lighting, indicating the means of egress from the building?*—E.H.

A. In my opinion, there is nothing in the N. E. Code that indicates such emergency lighting should be installed. Section 701d of the Code has a fine print recommenda-

tion that the current supply to a hospital operating room include a separate supply for emergency lighting. Note, however, that this recommendation only applies to the operating rooms and not the hallways of the hospital. Section 7001 of the Code tells us where emergency lighting must be installed. In general this provision covers theaters which are defined in Section 5201 of the Code. It also requires emergency lighting when such systems are required by Municipal, State or other Codes. While this latter provision covers a lot of ground, it appears to me that official interpretation No. 362, dated 9/8/50, clarifies the question. This interpretation advises that even though a City Building Code specified that exit signs and illuminated stairways be provided for means of egress in a hospital occupancy, the provisions of Article 700 would not apply.—B.A.McD.

Control Switch

Q. *When installing an electrically operated or illuminated sign, is it always necessary to locate a control switch within sight of the sign?* —F.M.M.

A. No. The Code does not require that the control switch be located within sight of the sign in all instances as Section 6003 of the Code states that the switch shall be located within sight of the sign or outline lighting which it controls unless it is of the type which may be locked in the open position.—G.R.

Insulation At Bushings

Q. *Section 3736b of the 1947 Code requires insulating bushings on conduits, containing conductors of No. 4 or larger, where they enter boxes, cabinets etc., and are deflected more than 30 degrees. I understand this has been changed in the 1951 Code. Kindly advise?—M.E.W.*

A. The 1951 Code, Section 3736b, eliminates the provision that applies to conductors that are deflected more than 30 degrees. As a result, all ungrounded conductors of No. 4 or larger where entering a raceway in a cabinet, pull box, junction box or auxiliary gutter shall be protected by insulating bushings or insulating material fastened in place, irrespective of the angle of deflection. I personally believe this new requirement is more than warranted from field experience

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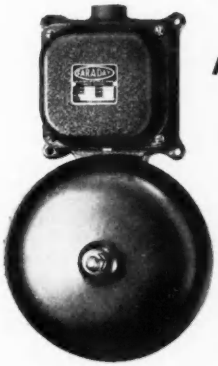

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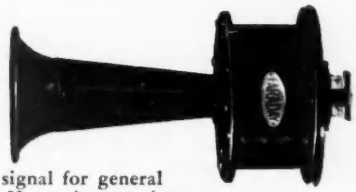

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over a number of years, which shows insulation failures at conduit bushings where the conductors entered and left boxes on a straight line with no deflection. Vibration, humidity, dampness all enter the picture when feeders fail on conduit bushings and this new Code provision should do much to eliminate such failures. It deserves our whole hearted support.—*B.A.McD.*

Grounding of 3 Phase 115 Volt Delta System

Q. *We have a 3 phase 115 volt Delta system to supply power for small motors mounted on manufacturing equipment. To supply local lighting at each machine, must we use an isolating 1 to 1 ratio transformer and ground one leg of the secondary side, or can the lighting be taken off directly through a properly fused two pole switch? This would mean that there would be no grounding of any circuit wires supplying the light on each machine.*

What is the intent of Section 2514 (1949 Code) with regard to grounding of such a 115 volt Delta circuit? —K.E.S.

A. One point of the 3 phase Delta system should be grounded. This will mean, of course, that on one of the phases, the light sockets will not have a grounded wire, but as the voltage will not exceed 300, Section 2113 (1) of the 1951 Code will not be violated.—F.N.M.S.

Type T Wire

Q. *Will the Type T insulated wire be approved when run through raceways in attics of residences where the actual temperature during summer months may be as high as 150 degrees F?*—S.M.

A. Under Section 3102-a, the Code states that no conductor shall be used under such conditions that its temperature, even when carrying current, will exceed the temperature specified in the table for the type of insulation involved. Also, under note 6 following paragraph: "In no case shall conductors be associated together in such a way with respect to the kind of circuit, the wiring method employed, or the number of conductors, that the limiting temperature of the conductors will be exceeded." Under note 7: "If the room temperature is within 10 degrees C of the maximum allowable operating temperature of

the insulation, it is desirable to use an insulation with a higher maximum allowable operating temperature; although insulation can be used in a room temperature approaching its maximum allowable operating temperature if the current is reduced in accordance with the table of correction factors for different room temperatures."

Some time ago an official interpretation was requested as to whether or not natural temperatures, such as those common to an attic, should be considered in determining the type of insulation to be used and the Official Interpretations Committee found that unless a room temperature was artificially raised by other than natural means, one might make use of the temperature shown on the top of Tables 1 and 2 of 86 degrees as the maximum temperature to be expected within a portion of the average dwelling. On the other hand, if you are sure there are temperatures anywhere near 150 degrees F, it would seem unwise to use an insulating material which would be damaged by exposure to such temperatures even though the Code would actually permit it.—G.R.

Reelites In Class 2 Hazardous Locations

Q. *Can you tell us if the Appleton Reelite No 752 conforms with the Code, when used in mill wiring in a dusty location?*—L.W.S.

A. The only Appleton Reelite which is approved by the Underwriters Laboratories for a Class 2, Group G, hazardous location, is the Reelite Type AE. This listing warns that the inspection authority having jurisdiction, should be consulted with regard to conditions under which this portable device will be permitted for use. The new Appleton 7S series is not listed by the U. L. for use in a Class 2, Group G, location and therefore would not satisfy the various Code rules involved with such a location.—B.A.McD.

Load For Dwellings

Q. *When is the effective date of the new Code which now requires that one assume three watts per square foot when determining the total load for a dwelling?*—E.W.

A. The 1951 edition of the National Electrical Code requires that we increase the lighting load for dwellings from two watts to three

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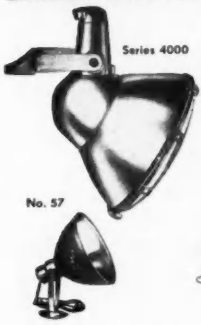

These STEBER Lines Meet All Requirements

STEBERLITES

Completely wired, weatherproof, cast aluminum Steberlites are ideal for the protection of vital industrial property and employees. They can be quickly and easily installed in literally hundreds of combinations to supply ample light where needed. Steberlites for Par-38 and R-40 spot and flood lamps can be mounted on poles, walls, outlet boxes, or directly to "T" conduit bodies. Write for Bulletin 120-51.

STEBER FLOODLIGHTS

The Steber line of floodlights sells in large volume to industrial and commercial users—to home owners and for sports area lighting. Open or enclosed types 100 to 1500 watt sizes are available. All are completely wired and fitted with versatile mounting brackets. Illustrated Bulletins 127-50 and 128-50 give complete data. Write for your free copies.

STEBER REFLECTORS

Here's a staple line with high turnover—a steady profit maker. Steber Reflectors are available in Ultranamel or Porcelain Enamel finish, shallow, standard, deep bowl, and sign (angle) types. Write for your copy of Bulletin 123.

STEBER MANUFACTURING CO.
Dept. 98
Broadview (Maywood P.O.), Ill.

STEBER

Steber Manufacturing Co. Bulletin ☐ 120-51
Broadview (Maywood P.O.), Ill. ☐ 127-50
Gentlemen: ☐ 128-50
Please Mail Bulletins checked. ☐ 123

*Individual's Name*_____
*Company Name*_____
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*City*_____ *Zone*__ *State*_____

YOUR SPECIFIC NEED

ASKAREL filled 750 KVA (three-phase) load center transformer for indoor or outdoor use.

is the job of *Standard* TRADE MARK

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● Your Standard representative stands ready to assume your most difficult transformer problems, and he is backed up by a competent Engineering Department that knows exactly how to accomplish the job you want done. Standard, with more than 30 years of experience, can meet your specific requirements without any alterations. Write us today for the name of your nearby representative. He can save you both time and money!

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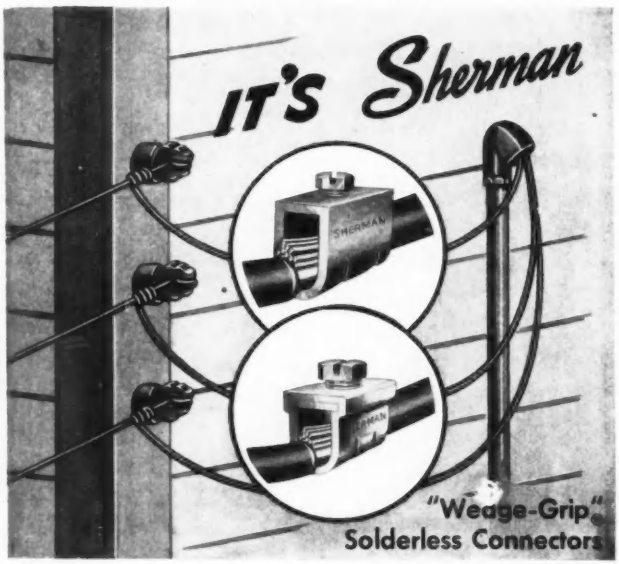


H. B. SHERMAN MANUFACTURING CO.
Battle Creek, Michigan

watts per square foot and while the first edition of this 1951 Code bears the date of January 2, I believe each authority enforcing this code is required to determine the effective date in his particular area or political subdivision. Inasmuch as the regular paper bound copies of the National Electrical Code as published by the National Board of Fire Underwriters were not available for general distribution prior to May 15, most inspection authorities will await naming an effective date until such time as they are reasonably assured of an adequate distribution of the new 1951 Codes. On the other hand, we must not lose sight of the fact that the rules as contained in the National Electrical Code are simply minimum provisions made in an attempt to safeguard lives and property and that a properly engineered wiring installation for any dwelling will be based on more than three watts per square foot.—G.R.

Fixtures Mounted On Combustible Surfaces

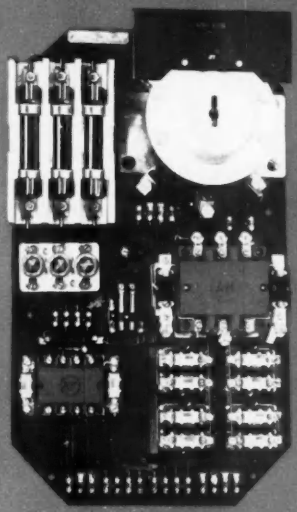
Q. *Will you please give your interpretation of N.E.C. ruling No. 4121, in regards to the installation of lighting fixtures with canopies that do not closely cover the outlet box when installed on wood or other fibre base sheathing board, such as fir-tax, Nu wood, Plywood and similar wall and ceiling boards?—S.W.*

A. Section 4124 of the Code requires that any combustible wall or ceiling finish exposed between the edge of a fixture canopy or pan and an outlet box, shall be covered with non-combustible material. For example, you install a 4 inch box in a combustible ceiling finish and the fixture to be installed has a 6 inch canopy. Such a combination would result, when installed, with 2 inches of combustible surface which would be exposed to a fire originating in the outlet box. In order to eliminate this fire hazard this 2 inch exposed combustible surface must be covered with non-combustible material, like asbestos lumber or any other non-combustible material.—*B.A.McD.*

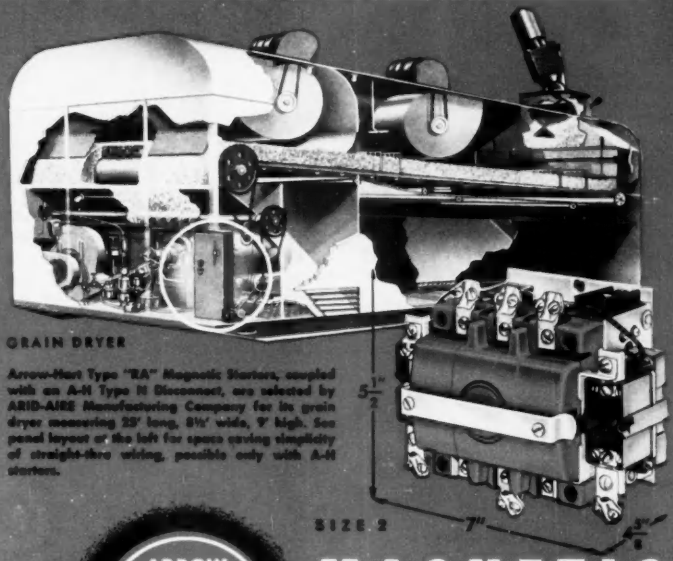
FRONTIERS FOR ELECTRICAL PROGRESS

The July issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE will include an appraisal of modern practices and trends in load analysis for wiring design.

BRING OUT **BUILT-IN PERFORMANCE** OF MOTORS AND MACHINERY



CONTROL PANEL



GRAIN DRYER

Arrow-Hart Type "RA" Magnetic Starters, coupled with an A-H Type H Disconnect, are selected by ARID-AIRE Manufacturing Company for its grain dryer measuring 25' long, 8½' wide, 9' high. See panel layout at the left for space saving simplicity of straight-thru wiring, possible only with A-H starters.

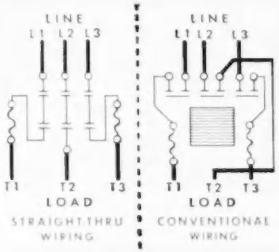
TYPE "RA"
RIGHT ANGLE

ARROW AH HART

MAGNETIC STARTERS

JUST 1/2 THE SPACE

PLUS STRAIGHT-THRU FRONT WIRING



Yes, to obtain maximum built-in performance from quality machines, use Arrow-Hart advanced design Type "RA" Magnetic Starters, smallest ever manufactured, first to give you ***straight-thru front wiring***. This means faster, neater installations at savings up to 30%; safer, direct routing with greater separation of line and load; immediate identification of circuits; elimination of crossing, looping, U-bending; no need for a load terminal on the line side. This simplicity with versatility is ***not*** possible with solenoid or other type starters. Compare the connection diagrams to the right and on the reverse side for conclusive proof of the straight-thru wiring benefits of Arrow-Hart Magnetic Starters — the most logical controls to specify, buy, and use. Available in sizes 0, 1, 2, 3 and 4.

COMPARE!

Write for folder complete with design and operating features, dimensions, ratings and other pertinent data.

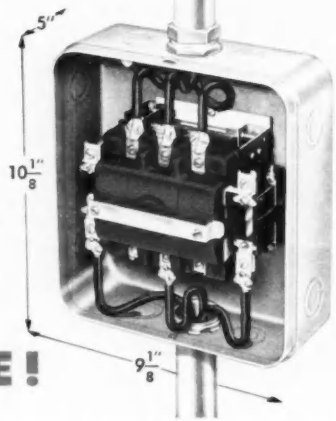
BUY WITH CONFIDENCE PROFIT BY PERFORMANCE

THE ARROW HART & HEGEMAN ELECTRIC COMPANY, HARTFORD, CONN., U. S. A.

ARROW AH HART

MORE BIG FEATURES IN JUST 1/2 THE SPACE!

TYPE "RA" MAGNETIC STARTERS



Arrow-Hart Magnetic Starters occupy just 1/2 the space of conventional starters. This means an overall reduction in the size of the control panel and a substantial reduction of material costs. The exclusive "RA" mechanism sets a new standard for functional simplicity in design — a new and superb performance acclaimed by more and more original equipment designers and manufacturers, electricians and maintenance men.

Other features include high arc resistant and suppression chambers for each set of contacts; big, heavy duty copper contacts with special silver alloy tips; guided parallel closure of contacts; improved magnet and coil; precision calibrated relays. All parts are easy to reach, wire and service for outstanding performance and economy.

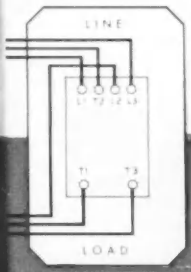
SIZE 2 ILLUSTRATED

MECHANISM DIMENSIONS
DEPTH — 4 5/8" HEIGHT — 5 1/2"
WIDTH INCL. RELAYS — 7"

COMPARE!

CONVENTIONAL WIRING

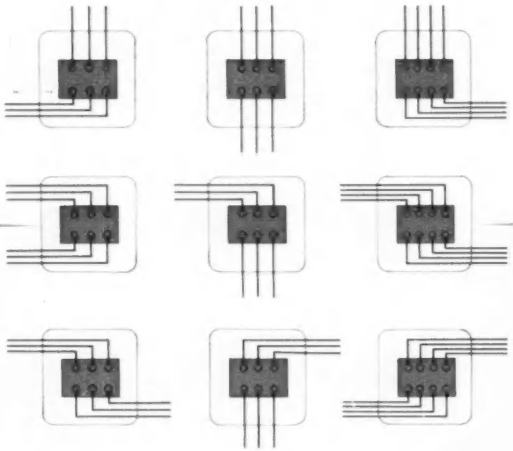
3 PHASE STARTER



AN EXAMPLE of wiring nuisance existing with old type solenoid starters. One load wire must be brought in to the line side.

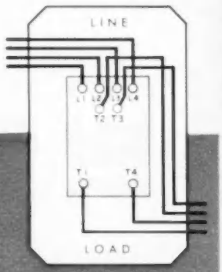
ARROW-HART STRAIGHT-THRU FRONT WIRING

LINE OR LOAD



CONVENTIONAL WIRING

2 PHASE 4 WIRE



ANOTHER EXAMPLE of scrambled wiring. Makes circuit identification more difficult and invites sequential errors.

Write today for folder and engineering data on Arrow-Hart Type "RA" Magnetic Starters and Contactors, complete with ratings, dimensions, and parts information. Available in local and remote control or selector switch types in sizes 0, 1, 2, 3 and 4. Consult your local electrical distributor or write the factory for engineering service. Field engineers are in your territory to assist you.

ARROW-HART

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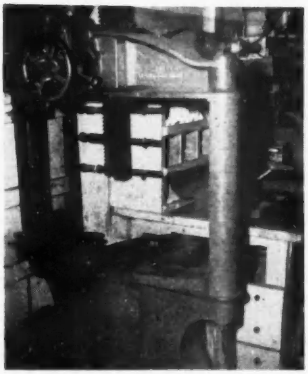
Motor Shops



HYDRAULIC PRESS is equipped with variable-width yoke, permitting the use of a firm shoulder for all operations requiring the operation of the device.

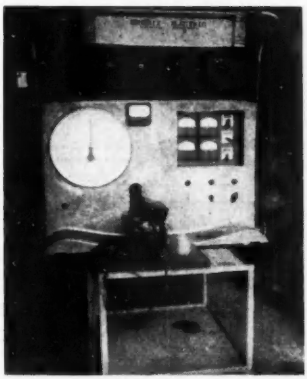
Variable-Width Yoke For Hydraulic Press

When shafts are pushed into or out of rotors in the shop of the Tennessee Electric Motor Service Company, Nashville, a variable-width yoke or collar is used. This yoke is pinned and can be swung back and forth, and the width of the yoke is varied so that, as it is swung, the base opening is decreased or widened. In pressing a shaft, this feature is of considerable use, for the yoke can be adjusted in accordance with the equipment, and a firm shoulder will be available for all operations. The yoke was cut and fitted in the company's shop and has rendered valuable service since its construction.

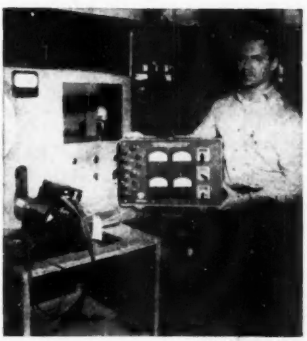
Motor Test Unit Uses Industrial Analyzer

A conventional Westinghouse Type TA industrial analyzer does double duty in the motor repair shop of the Phoenix Electric Company at Mansfield, Ohio. In addition to using the instrument in the field for test purposes, R. A. Bonham, co-partner of the repair firm has incorporated it as an integral part of a dynamometer unit he designed and built to test small motors. The analyzer proved a good substitute for a number of instruments that normally would have to be installed on the dynamometer instrument panel.

Base of the unit is a metal table fabricated from angle-iron and sheet steel and mounted on casters. Motors under test rest on a sponge rubber pad on the table top. The heart of the dynamometer set is mounted on the back of a large metal instrument panel. A friction-type brake drum, with hand wheel adjustment, has its shaft protruding through the panel; is connected to the test motor shaft by a Jacobs chuck arrangement; has an electric tachometer attachment which registers on a 0-4,000 rpm. meter on the panel. The drum and tachometer assembly is mounted on a vertical sliding base which can be raised or lowered by hand wheel to meet shaft heights of different motors under test.

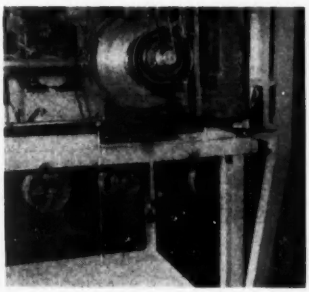


DYNAMOMETER for small motor testing uses standard industrial analyzer unit (upper right) to supply most of the panel instruments.



ANALYZER can be quickly removed from panel for field use. R. A. Bonham, designer of the dynamometer, demonstrates this feature.

HEART OF UNIT is on back of the panel. Analyzer (1) rests on special shelf. Friction brake arm has dual cable attachment (2) for positive dial reading for forward or reverse motor rotation. Motor is loaded by rod (3).



DUAL CABLES have common connection (arrow) to dynamometer dial cable. Forward or reverse motor rotation will always pull dial cable downward.

A 0-25 pound dynamometer scale on the panel gives positive readings for both clockwise and counter-clockwise motor rotation. This is accomplished by attaching two cables—one to the top and one to the bottom of the drum arm. After passing over a series of pulleys, these two cables have a common junction with the cable attached to the scale. Regardless whether the arm goes up or down, the cable on the scale always is pulled downward.

The industrial analyzer provides the rest of the instruments on the dynamometer. The analyzer case, with cover removed, is mounted on a special shelf on the back of the panel; can be quickly removed for field use by simply removing a few connections and lifting off the shelf. The meters and operating switches are framed in an

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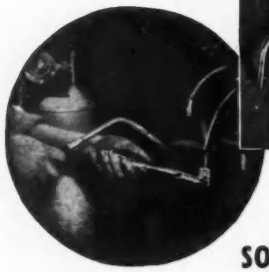
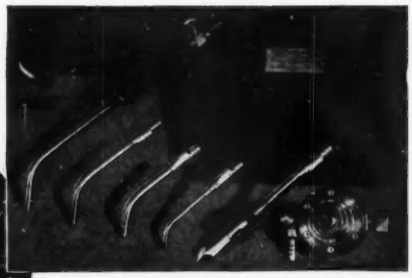
Trade-Mark

5-in-1 Outfit





5-in-1 Precision Outfit . . . $22.50

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An all 'round outfit—as easy to use on a pole or underground as in the shop . . . Four stems and soldering copper handle all soldering, heating, and brazing work . . . Needle valve control gives exact flame and heat for each job . . . Lights instantly at full heat regardless of drafts or weather . . . No pumping, priming, or generating . . . No smoke or fumes.

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assures dependable communication

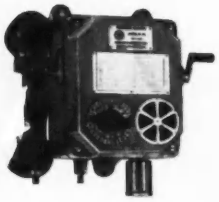
"BOMBS AWAY"

(in enemy language)

Could mean no communication in your plant . . .

Any communication system depending upon outside power supply is unusually vulnerable.

Investigate the permanent, or emergency, systems offered through U. S. I. sound powered telephones.



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UNITED STATES INSTRUMENT CORPORATION

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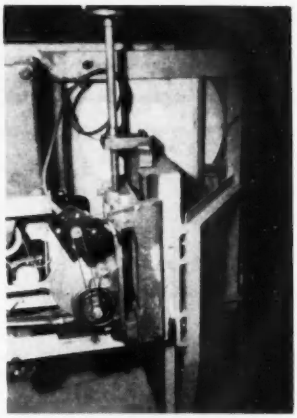


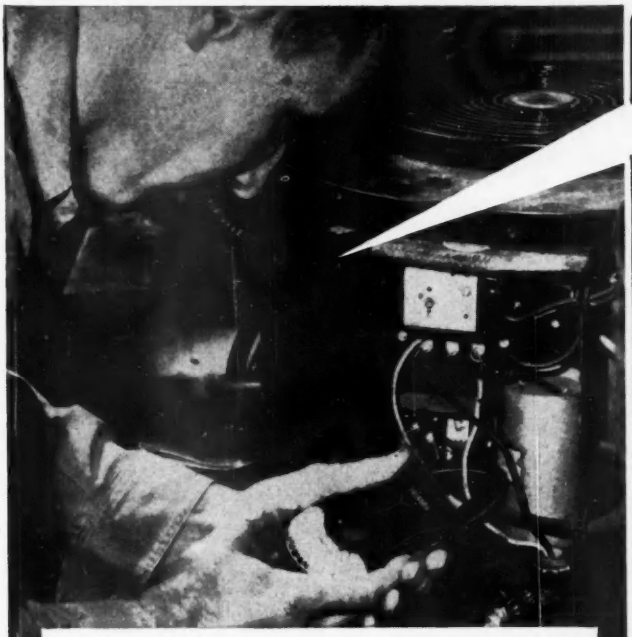
HANDWHEEL ADJUSTMENT raises or lowers brake drum assembly to meet height of motor shaft under test. Motor shaft is coupled to drum by Jacobs chuck arrangement.

opening cut in the dynamometer panel.

Three switches (all with pilot lights) on the panel control dynamometer operation. A toggle switch on the left cuts in an electric timer for automatic checking of motor starting switches (on two times each minute). If desired, starting switches can be checked manually by a foot control. A selector switch (center) connects the unit to the desired test voltages (110 or 220-volt, single-phase; or 220-volt, 3-phase). Another selector switch (right) is for the dual-scale ammeter. To check voltage and current on 3-phase motors under test, the regular analyzer switches are used.

Bonham uses the dynamometer on single and three-phase motors up to three horsepower in size; finds it an efficient time-saver when checking incoming repairs and outgoing jobs.

ADVANTAGES OF infra-red combination dip-bake unit for medium size motors are being discussed by (L to R) H. B. Nussbaum, partner; and Dan Kennedy, shop superintendent, of V. M. Nussbaum & Co., motor repair specialists of Ft. Wayne, Indiana.



"We find as many occasions to use our Amprobes as we do our pressure gauges – and in refrigeration, that's saying plenty!", writes Mr. Schilling. "An invaluable tool for checking start and run current influx (especially good on sealed units), voltages, causes of fuse blow-outs, and dozens of other uses."

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owner, Schilling Chilling Company, 1403 E. Southern, Indianapolis, Ind.

$49.50 *complete with genuine top grain cowhide leather case and voltage test leads.*

OTHER AMPROBE USERS SAY:

"Far superior to any instrument of any type performing the same service that I ever saw or used. A 'must' item for any refrigeration serviceman or electrician."—*Roy V. Culy, Culy Refrigeration Service, Richmond, Ind.*

"The Amprobe is easy to take with you when you go to check a motor, due to its small size. Also, the design of the jaws will let the Amprobe work inside the terminal box on most motors."—*Leycester Moore, Moore Electrical Motor Service, Brady, Texas.*

"One of the handiest instruments I ever owned. It is so small and accurate, I am sorry I never had one before this."—*Kenneth O. Bultman, Electrician, Fairborn, Ohio.*

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Reads current without interrupting circuit or breaking insulation

Look what you can do with this one pocket-size tool: Determine load conditions instantly without having to shut down equipment. Spot motor overloads and underloads. Diagnose trouble calls faster, under actual load. Check line voltage and drops. Set overload relays, etc.

- So compact, it fits in your pocket.
- ½ the usual size—only 7".
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- Accuracy: ±3% (of full scale deflection).
- Field-proved and accepted – tens of thousands in daily use today.
- About ½ the usual price.

AMPROBE 10X SENSITIZER

Effectively gives the Amprobe 3 additional ranges: 0-1 AMPS. 0-2.5 AMPS. 0-5 AMPS. **$3.75**

Model A-6 measures 5 A.C. current ranges: 10/25/50/100/250 amperes; plus 2 A.C. voltage ranges: 150/600 volts. Two other models available.

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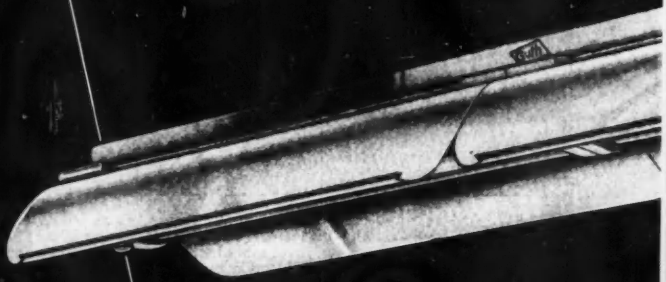
(print your name, company and address in the margin)

it's all Polar Bear White



for 4′ and 8′ lamps

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White INSIDE and OUTSIDE... 300° Permalux or PORCELAIN ENAMEL!

- give improved brightness ratios
- take the gloom off the ceiling
- eliminate deep shadows and strong contrasts
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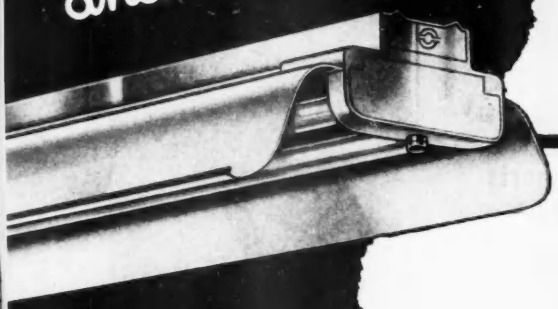
for better sight and better light



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provides natural air circulation along entire channel to increase ballast life and efficiency.

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wide choice of mounting methods . . . continuous or individual

- *sliding hangers*
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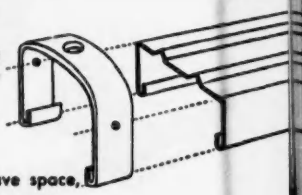

interchangeable parts save space, time and money, easy to install

one of many mounting possibilities: alternate fixture and blank space with covered, continuous wire way

Guth

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in 2 and 3 40-watt light units, for 4-and 8-ft. Slimline in 4-and 8-ft. lengths.

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are now in production and will be available soon.

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GREENLEE HYDRAULIC BENDER

Yes, quickly make bends *exactly* as you want them, when you want them, where you want them. Compact, portable GREENLEE Hydraulic Pipe and Conduit Bender lets you do this in a jiffy. *One-man operated* to produce smooth, accurate bends in just a few minutes . . . in pipe up to 5", rigid and thin-wall conduit, tubing, bus-bars. Owners report timesavings up to 60% and more, elimination of cost for manufactured bends and fittings, and "clean", tailor-made installations every time. Get facts now on this time-saving tool that often pays for itself on first few jobs! Write for free Bender Booklet, Greenlee Tool Co., 1746 Columbia Avenue, Rockford, Illinois.

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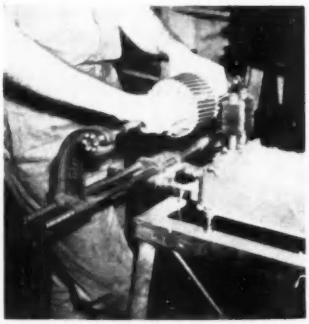
One of several ovens in the shop of the Central Electric Company, Cambridge, Massachusetts, is fired by gas; the burner unit consisting of three concentric rings and a spark gap for igniting the gas when the burner is placed in operation. Motor stators and other equipments are supported above the frames on angle-iron rests that can be moved in or out on rails. The hood contains built-in vaporproof lights (in the front) and an exhaust duct (in the rear), thus providing illumination for inspection and ventilation for volatile gasses. Switches for gas, spark ignition, lights and exhaust are conveniently located on the front frame of the oven.



PORTABLE INSULATION SKINNER at Central Electric Company, motor service shop in Ft. Worth, Texas, has an adjustable bracket attachment to hold armatures of various diameters and shaft lengths. Cover is removed to show rotating wire brushes. Angle-iron supporting frame for unit has wheels on two front legs. Rear legs rest on floor to hold unit stationary during operation.

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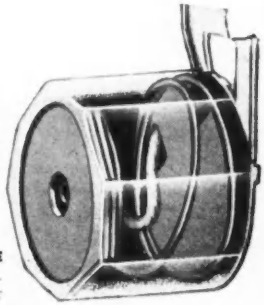

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R5062S

Industrial Electrification

To Grease Or Not To Grease?

Users of ball bearing electric motors should have full information before answering this question.

By W. O. Wulfert
Chief Mechanical Engineer
Electrical Division
Wagner Electric Corporation
St. Louis, Mo.

A basic knowledge of lubricants and lubrication technique is essential to the proper maintenance of the many types and sizes of electric motors used in modern industry. No machinery can be expected to operate without lubrication, and to obtain the most efficient operation and the longest life from electric motors, it is usually recommended that the lubricant be replenished or renewed at regular intervals.

The essential ingredient of all lubricating agents is oil, either in its free state or suspended in a compound, as in the case of grease. Various lubricating devices are used to deliver the oil to the moving parts. The devices listed below apply in variable extent to both sleeve bearings and roller type bearings.

1. A SIMPLE HOLE leading to the revolving member. This device is satisfactory only if the apparatus is used intermittently, or if lubricant is added frequently or continuously.

2. WOOL YARN, which lifts oil from a reservoir by capillary action. This method works very well on comparatively small machines which operate in a horizontal position.

3. AN OIL RING, chain or similar device which delivers oil from a reservoir to the revolving member. This method is used on larger apparatus operating in a horizontal position.

4. AN OIL PUMP which continuously circulates oil from a reservoir to the bearing surface. This method can be used for very large units, but it is usually too expensive, both in original cost and in up-keep, to be extensively used for ordinary applications.

5. A SLINGER or air jet which delivers oil to the bearing surface. This method may be necessary for extremely high speed applications where extreme rigidity is required, such as the grinding of ball bearing races. It requires constant maintenance, and is seldom used except when other methods of lubrication have failed.

6. GREASE, which is used as a storage reservoir for the oil, releasing it to the bearing surfaces. Grease can be applied in a number of ways; usually a considerable mass of grease contacts the rolling elements. While the soap or filler that holds the grease in a semi-solid condition may have some lubricating value, the essential lubricating ingredient is oil. When the proper type of grease is used, oil is delivered to the bearing in the required amount with minimum attention.

Grease lubrication is used for most applications of ball bearings to electric motors because it provides the following advantages:

1. Simplicity of bearing housing.
2. Minimum space requirement.
3. Minimum loss of lubricant.
4. Ease of relubrication when required.

Much progress has been made through modern research in developing improved greases for motor lubrication. A good grease is one that will:

1. Lubricate the balls and races.

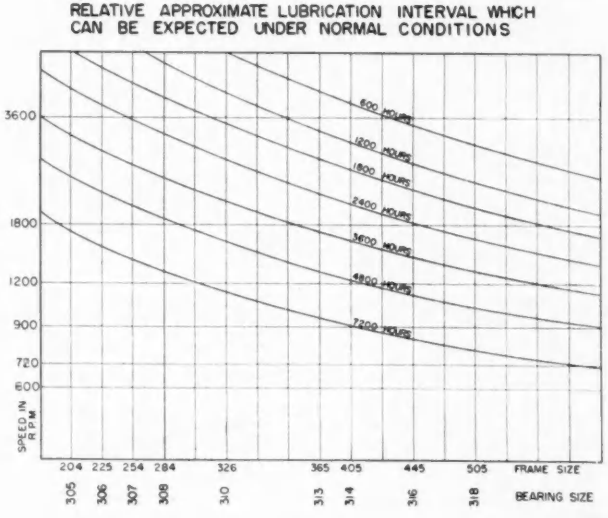

FIGURE 1

SPEED AND BEARING SIZE affect lubricant life. Chart indicates that many small motors should not require relubrication during life of the unit, although annual checking is recommended. Large units operating under severe conditions call for closer inspection and more frequent greasing.

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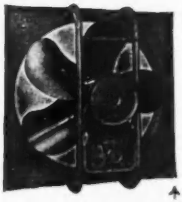

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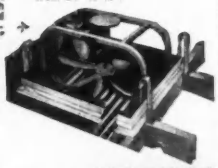

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reducing the wear caused by sliding friction.

2. Lubricate the cages or retainers, reducing the wear caused by rubbing action.

3. Prevent corrosion of the bearing surfaces.

4. Prevent the escape of the lubricant from the housing.

Bearing Life

The life of the bearing depends on the life of the lubricant used, which is affected by a number of factors such as:

1. The type of grease used.
2. The hours of operation per day.
3. The surface speed of the rolling member.
4. Operating conditions.
5. Load conditions.

Common causes of ball bearing failure are

1. CARELESSNESS—If dirt or other foreign matter is allowed to enter the bearing housing, the rolling surfaces will be damaged. Rapid wear and noisy operation will result.

2. OVERLOADING — A motor capable of handling a specific load may be overloaded because of excessive belt tension or because it is not properly aligned with the driven machine. Such overloading causes flaking of the bearing surfaces and cracking of the balls, with consequent rapid bearing failure.

3. IMPROPER GREASE—If the grease used does not have the proper characteristics, the oil will separate from the soap, producing a sludge which resists the rotation of the bearing. If this condition becomes extreme, excessive bearing temperature results.

4. OVERLUBRICATION — At high bearing speeds, if the housing contains too much grease, a churning action occurs with results similar to those caused by improper grease.

5. LACK OF LUBRICATION — This, of course, is fatal. Wear and corrosion quickly ruin the bearing completely.

Figure 1 shows the approximate lubrication intervals recommended for ball bearing electric motors under normal operating conditions. Under severe conditions, involving high temperatures or unusual service, the greasing interval can best be determined by experience. Periodical examinations will soon indicate how long the motor will remain properly lubricated.

According to Figure 1, the size of the bearing and the speed at which the motor operates are two important factors that affect the life of the lubricant, which in turn affects the life of the bearing unless the lubricant is

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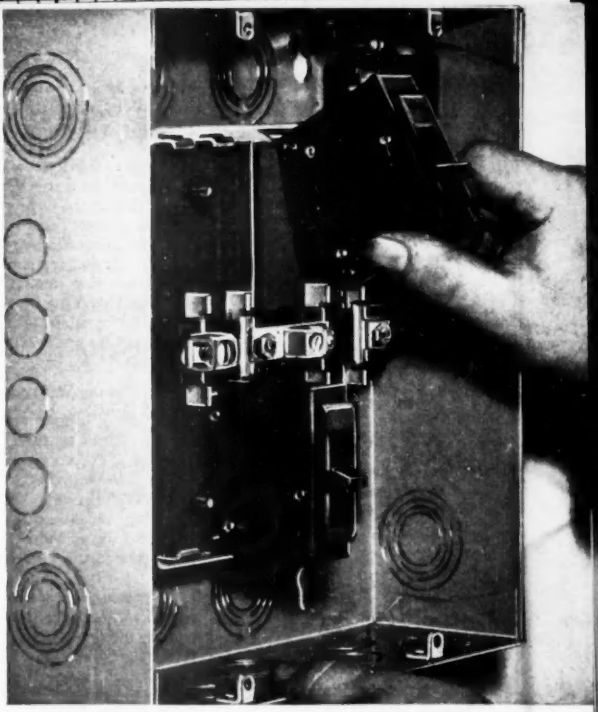

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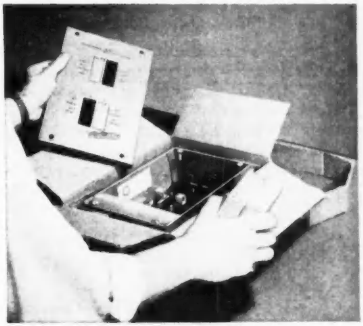

TWO BREAKERS PACKED along with enclosure and interior. Sufficient space is left to include a front and additional breakers. The fronts and additional breakers are individually packaged and stocked separately to suit individual customer's requirement.

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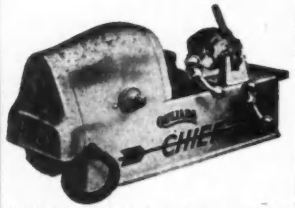

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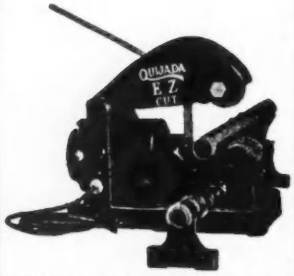

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renewed in time. Motors in the smaller frame sizes will often operate for the life of the unit without relubrication; in the larger frame sizes, frequent lubrication may be required, although in many cases, where service conditions are not severe, large motors have operated for years without additional lubrication.

In normal applications, it is recommended that motors be relubricated annually, unless the size and speed of the motor indicate that a shorter relubrication interval is a wise precaution.

Bearing Housing Construction

Figure 2 shows, in cross section, the type of housing used for a typical fractional horsepower ball bearing motor. The lubricant contained in the original bearing is usually sufficient for a long period of operation. A lubrication means is provided, however, so the bearing can be relubricated if necessary.

Figure 3 shows the two-cap design housing used for our standard open-type integral horsepower ball bearing motors. Two lubrication openings are provided, one for adding new lubricant and the other for draining excess lubricant. Labyrinth seals retain the lubricant and also prevent the entrance of dirt, dust or other foreign matter while the motor is operating.

The condition of the lubricant and the rolling elements can be observed by removing the bearing cap. If the rotor has to be removed from the motor, for repairs to the windings or other reasons, the two bearing caps can be clamped together to protect the bearing against dirt and damage.

Figure 4 shows the housing used for externally ventilated (totally enclosed fan-cooled) motors. As in the previous design, two lubrication openings and labyrinth seals are provided, and the outside bearing cap can be removed to check the condition of the lubricant and the rolling elements. With this design, it is possible to remove the rotor without exposing the bearings.

Figure 5 shows an additional feature of the lubrication method used for totally enclosed fan-cooled motors: long grease pipes are provided to make relubrication of the bearing more convenient. Also, by passing a rod or wire completely through these pipes and the housing, (while the motor is not running) it is possible to force the old grease out of the housing. New grease entering the housing will be

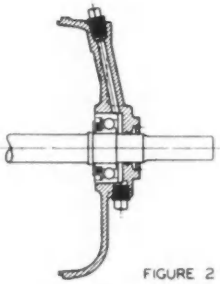


FIGURE 2

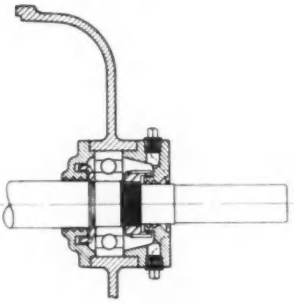
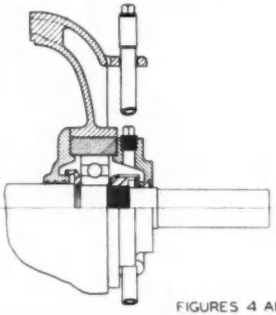
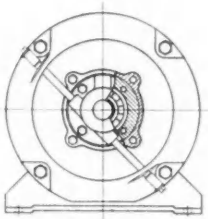


FIGURE 3





FIGURES 4 AND 5

LUBRICATION of typical fractional horsepower motor (2) should last indefinitely, although provision is made for addition if required. Open-type integral hp ball-bearing motors frequently have 2-cap housing (3). Totally-enclosed fan-cooled motors (4&5) have labyrinth seals with removable outside bearing caps.

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Special Cases

There are certain applications where relubrication of motors may be inadvisable or undesirable, such as:

1. Some manufacturing plants, such as textile mills, where the presence of any oil or grease is objectionable. In these cases, ultimate bearing failure and replacement of the motor is usually preferred to the risk of having the product damaged by excess lubricant.

2. Locations where it is inconvenient, dangerous or even impossible to relubricate the bearings. In such cases, it may be more economical to postpone any attention to the motor until bearing failure or other breakdown occurs.

3. Particularly dirty locations, such as coal mines, where it is practically impossible to relubricate without danger of adding dirt, grit or other harmful substances along with the grease. In such cases, it is better to wait until repairs are in order before attempting to lubricate the bearings.

4. Many industries which, because of rigid requirements for continuous operation, have definite schedules for overhauling all equipment. In such cases, relubrication can be omitted until time for overhauling.

Sealed, Pre-Lubricated Bearings

The sealed, pre-lubricated bearings can be used for many motor applications, and may be desirable in motors where definite requirements are specified. One advantage of the sealed, prelubricated bearing is that it permits use of an extremely simple bearing housing.

Certain limitations, however, would indicate that the sealed, prelubricated bearing is not completely satisfactory for the general purpose motor. The chief difficulty arises when the bearing ultimately fails, as it will, and then it is necessary to remove the motor and perform major repairs. A little added grease might have prolonged the motor's life considerably.

General purpose motors with housing designs such as shown in Figures 2, 3 and 4 have all the advantages of the sealed, pre-lubricated bearing design—you don't have to lubricate them if you don't want to—with the added advantage that the motor can be lubricated if necessary or desirable. The same rolling elements and the same lubricant are used in both designs.

Referring again to Figure 1, the life of the bearing is limited by the life of the lubricant, which is determined largely by the size of the bearing and the speed at which it revolves. The

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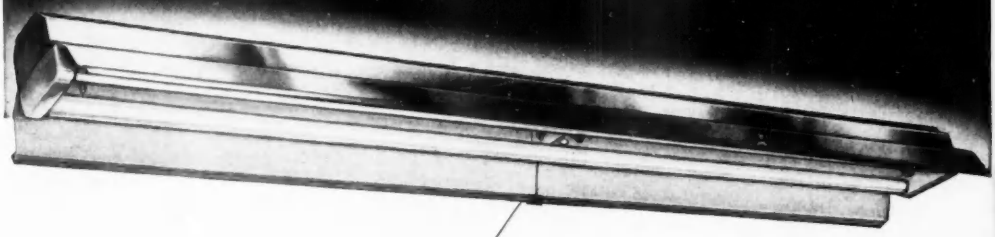

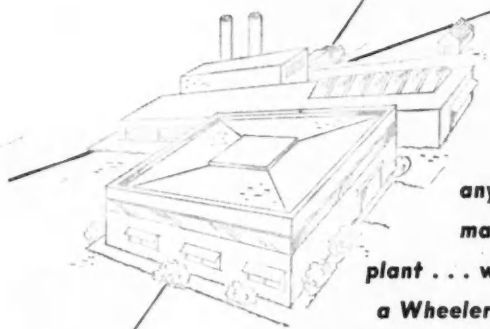

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Century 1 TO 400 H.P. MOTORS

Choose From These Many Types To Fit Your Job

DEPENDABLE CONSTRUCTION . . . Plus

PROPER SELECTION MINIMIZE SHUTDOWNS

Century Electric Company is celebrating its 50th year in the electrical industry.

It's easy to select the proper electric motor for your job from Century's complete line — from 1/6 to 400 horsepower. A wide range of types and kinds are available to satisfy all popular requirements. They are carefully designed, built and tested to assure maximum performance throughout their long life.

Here are examples of Century's line of INTEGRAL HORSEPOWER motors.

Polyphase

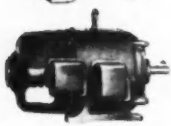
TYPE SC—Open Drip proof General Purpose Motor. Meets the needs of most installations where operating conditions are relatively clean and dry.

TYPE SC—Splash proof. Supplies protection where plants must be washed down. Keeps out all falling or splashing liquids—rain, snow, sleet, etc.

TYPE SC—Totally Enclosed Fan Cooled. Protects against dusts, mist, oil, fog. Inner frame protects vital parts of the motor, seals out harmful matter.

TYPE SC—Explosion proof. Protects life and property in atmospheres charged with explosive dusts or gases.

TYPE SR—Wound Rotor. Open Construction. Ideal for applications requiring low starting current with high starting torque, reversing or adjustable speed.



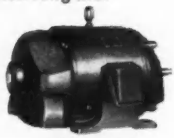
TYPE SR—Wound Rotor Splash proof. Same electrical characteristics as motor shown above. In addition, gives adequate protection against falling and splashing liquids.

Single Phase

TYPE RS—Repulsion Start Induction, Open Construction, Single Phase Brush Lifting Motor. Combines high starting torque with low starting current.

683

TYPE RS—Splash proof. Same advantages as open construction, plus protection against splashing and falling liquids.



TYPE CSH—Capacitor Start Induction, Single Phase Motor. Suitable when high starting torque with normal starting current is satisfactory.

TYPE CSH—Splash proof. Same advantages as motor shown above, plus protection against falling and splashing liquids.

Direct Current

TYPE DN—Direct Current Motors. Suitable for use where direct current is available, or its use desirable.

TYPE DN—Direct Current, Splash proof.

TYPE SY—Synchronous. Suitable for continuous operation at a uniform load for power factor correction.

In addition to a complete line of integral horsepower motors, Century offers fractional horsepower motors, gear motors, generators, AC and DC motor generator sets.

For a long life of satisfactory performance, specify Century motors for all your electric power requirements.

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life of the sealed, pre-lubricated bearing, therefore, is definitely limited, while the life of bearings that can be relubricated can be prolonged indefinitely.

Buyers have, at various times, specified motors without provisions for relubrication. With our design, it was possible to meet these specifications by closing the lubrication openings in the housing with removable threaded plugs, and issuing instructions to add no lubricant. Several other motor manufacturers, on such orders, actually sealed the bearings. When it later developed that motor failures were resulting from lack of lubrication, it was necessary to rebuild these units to provide means for relubrication, while with the Wagner motors it was a simple matter to remove the threaded plugs and insert the necessary lubricating device.

One application was made a number of years ago, which specified fractional horsepower motors with sealed bearings to be used on gasoline pumps. Bearing failure in this case was caused by spilled gasoline which entered the bearing housing. This, of course, is an exceptional case, but it illustrates the value of providing means for relubrication even though no immediate need for them is foreseen.

Choice of Lubricant

The type of grease used to lubricate the ball bearings of electric motors is one of the most important factors contributing to long bearing life. It should be thoroughly tested, and has proved satisfactory during long service in practically all industries.

Unusual temperatures and other severe operating conditions may make the use of special lubrication procedure or special lubricants necessary. Whenever possible, however, in order to reduce the number of lubricants used and thereby reduce the possibility of error, a standard lubricant should be used. For high speed applications, for example, it is usually preferrable to apply lubricant more frequently than to stock a special grease particularly suited for high speed operation. When use of a special lubricant is essential, information regarding such a lubricant can be obtained from the motor manufacturer or the lubrication engineer of the grease supplier.

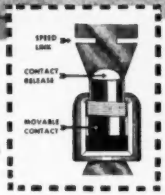
Lubrication Procedure

The lubrication of electric motors in service is an important factor in the efficient operation of any industry. Since the operation of adding lubricant to a housing is apparently a very simple matter, the natural tendency might be to consider this an operation that can be done by anyone, without specific instructions.

how to keep hot circuits cool

Trion

DUAL ELEMENT TRIPLE PROTECTION FUSE WITH THERM-A-TRIP



HOW IT WORKS

A short circuit blows speed link instantly. Therm-A-Trip (matched to thermal capacity of the motor or transformer it protects) also opens circuit when safe surrounding or load temperatures are exceeded. Provides adequate protection with extra long time delay.

Trion—THE THREE-IN-ONE FUSE

TRION is the coolest operating fuse of any type.
TRION gives instantaneous cut-off on short circuit.
TRION controls rate of rise of recovery voltage.
TRION has longest safe time-lag of any overload protective device.
TRION's time-delay averages five times longer than any renewable or one-time fuse.
TRION starts heavily loaded motors safely.
TRION protects against single phasing.
TRION's watt (power) loss is substantially lower.
TRION's tripping temperature provides a heat ceiling 500° F. lower than any zinc link fuse.
TRION reduces and controls the heating of switches and fuse clips.
TRION permits the use of switches of lower rating.
TRION keeps hot circuits cool.

A TRION FOR EVERY CIRCUIT

Trions are available in 141 Standard Sizes ranging from 1 to 600 amps for both 250 and 600 Volt circuits. Other sizes for these same voltages range from 1/10 amp to 9 amps. Midget Sizes (3/8" dia. by 1 1/2" long) vary from 1/10 amp to 10 amps. ASK FOR TRION OR WRITE FOR FREE TRION BULLETIN #506-A TODAY.

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MR. GEORGE R. LOCKWOOD, Owner
LOCKWOOD'S ELECTRIC MOTOR SERVICE, Trenton, New Jersey

Dow Corning Silicones Build Rewind Business. Put your customers' interests first — or put your own best interests first. In either case it means Class H Insulation made with Dow Corning Silicones for hardworking motors. Your customers get the best electrical insulation money can buy; you get new business, more profits and an A-1 reputation among your customers.

This new class of electrical insulation enables you to solve your customer's most difficult motor problems. That's because Class H Insulation made with Dow Corning Silicones gives greater protection against overloads, heat and moisture. Laboratory tests and on-the-job experience prove that Class H Insulation has at least 10 times the life and 10 times the wet insulation resistance of Class B insulating materials.

Offer Dow Corning Silicone (Class H) Insulation for hard working motors and you offer a service that sets you up as an authority. Your shop gains first consideration, even for ordinary jobs. You earn a better profit margin on Class H business; you gain prestige and win those new customers that increase your total volume of business.

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Such haphazard maintenance, however, may result in more harm than good. Certain fundamentals, such as cleanliness and the proper type and the proper amount of grease, must be considered, and the job should be done by a competent mechanic who realizes that he is responsible for the efficient operation of expensive equipment.

1. All new motors are inspected when installed, and lubricated if necessary. This is especially important in the case of sleeve bearing motors, which are usually shipped without oil.
2. Ball bearing motors are lubricated once a year. Certain motors are lubricated at shorter intervals, if the original inspection or the yearly inspection has indicated that additional attention is required.
3. When trouble occurs in any motor, the plant electrician is notified and investigation of the trouble and the necessary repair or replacement of the unit is done by workmen under his supervision.
4. These instructions are followed for annual lubrication of ball bearing motors:
   a. Blow out all dirt, and give exterior of motor a thorough cleaning.
   b. Remove the pipe plug from both the lubrication and the drain opening.
   c. Run a rod or wire part way into the lubrication opening to determine if the grease is dry and hard.
   d. If the grease is hard, run the motor while adding a little oil to soften up the grease. Operate the motor until the grease starts to run out of the drain opening.
   e. Stop the motor and add grease until the old black grease has passed out of the drain opening and the new grease starts to come out. The grease is added to the housing by means of a standard grease cup.
   f. Operate the motor and allow the bearing to force out excess grease.
   g. Stop the motor and run the rod or wire into the lubrication opening and the drain opening, to force out a quantity of the grease. This allows for expansion of the grease when the motor is operating.
   h. Replace both pipe plugs.
   i. Run the motor. Make report indicating whether or not the motor is considered to be in satisfactory operating condition. If the condition is not satisfactory, investigation is made by the plant electrician.

In conclusion, general purpose motors should be provided with an adequate means for relubrication, and a regular lubrication procedure will add to the useful life of such motors.

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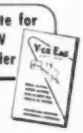

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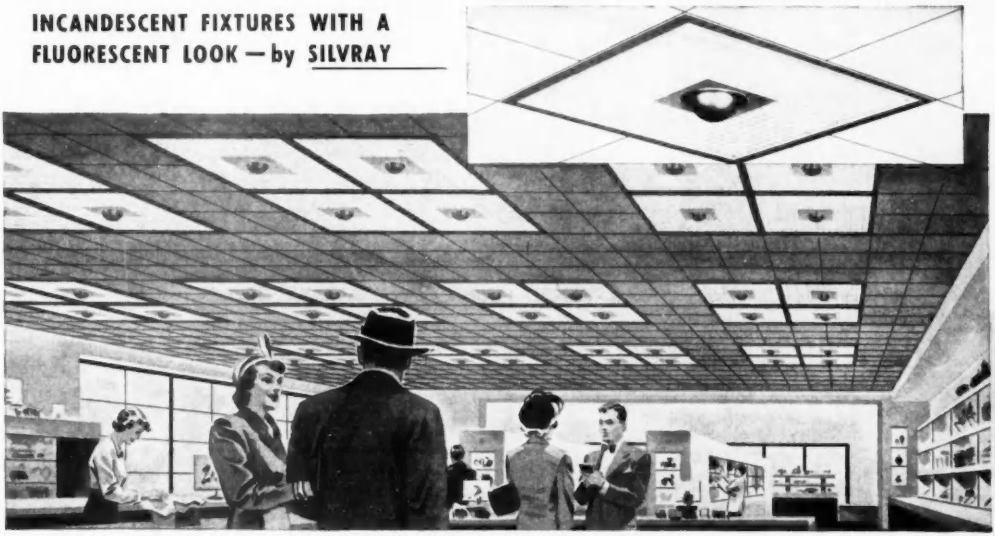
Why contractors are recommending Skylike® Lighting

INCANDESCENT FIXTURES WITH A FLUORESCENT LOOK — by SILVRAY



Introduced only a few months ago, Silvray **SKYLIKE** lighting has already been recommended and installed by contractors in showrooms, schools, stores, offices, laboratories, and other interiors all over the nation.

Behind this almost immediate acceptance is the fact that the **SKYLIKE** lighting system combines the best features of silvered-bowl incandescent units with the modern appearance of fluorescent-type troffers—a combination long desired by most contractors and architects.

In fact, *only* Silvray **SKYLIKE** fixtures can provide all of the following features:

1. **Low cost—only 1/2 to 1/3 as much as other equipment delivering comparable results.**
2. **High initial and maintained light output.**
3. **Softly diffused shadows, low brightness levels, and 90° shielding.**
4. **Warm color—most desired by merchandising experts.**
5. **Instant starting.**
6. **No flickering, blinking, or hum.**
7. **Variable lamp size—150- to 500-watt.**
8. **No light loss from darkened walls or ceilings.**
9. **Floor-service relamping—no ladders or scaffolds.**
10. **Hermetically sealed silver reflecting surface.**

SKYLIKE systems are flexible and easy to plan. Units fit 24″ x 24″ ceiling tiles . . . can be fully or partially recessed, or surface mounted—in rows or patterns. Weighing only 15 pounds—less than half the weight of other recessed fixtures—they require minimum support . . . eliminate the extra labor and materials involved in heavy framing.

SKYLIKE units are simple in construction and internal wiring—there are no starters, ballasts, or transformers to get out of order and cause costly service call-backs.

Maintenance men, too, like the ease with which a **SKYLIKE** unit can be relamped from the floor . . . the way its easily accessible baked enamel reflector wipes clean with a damp cloth.

Try Silvray **SKYLIKE** units on your next lighting installation—you can get complete details by simply mailing the coupon below.

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"A BOX FOR EVERY NEED"

In The News

Protective Lighting

Safeguards against sabotage, espionage, destruction of property, and theft are receiving increasing attention, from federal, state and local government, the military, and from industry. Quietly and unobtrusively, meetings have been held recently, by many and varied groups. Purpose of these meetings has been to explore generally what should be done, and how, where, and by whom it should be done.

This has consistently been a live subject with the military, and they have provided some guidance in the past through Munitions Board pamphlets. More recently, the Atomic Energy Commission, Federal Communications Commission and Federal Power Commission have become alarmed over the threat of sabotage. So, now, is industry; which was jolted recently when FBI Director J. Edgar Hoover told a congressional committee that there are 43,217 known Communists in the country, and that "a hard core" are trained saboteurs ready to cause trouble in vital industries if war comes.

Washington's sub rosa Industrial Evaluation Board, probably the most hush-hush group today outside the military secret services, was set up several months ago. Its mission: 1) determine relative importance of protecting plants, facilities, materials, etc. (practically everything), from injury and destruction by enemy activity, espionage, accident, fire, sabotage, etc.; 2) gather information on security of economic resources; 3) assign key facilities to appropriate agencies of the government for security supervision.

Typical of meetings growing out of this concern, and local Civil Defense activities, was a recent New York University-sponsored 3-day "Plant Protection Seminar", with open discussion on "Current Problems of Industrial and Institutional Plant Protection".

Recently, U. S. Chamber of Commerce devoted part of its annual meeting to a discussion of plant protection. Talk centered largely on who is responsible for protecting government secrets and defense production facilities. Conclusion was that primary responsibility lies with management, which must police its properties and see that that Defense Dept. protective rules are adhered to. The Munitions Board has available two pamphlets to help employees do that: 1) "Principles of Plant Protection", issued August 1, 1950 (15¢ at Government Printing office), and 2) "Industrial Security Manual for Safeguarding Classified Matter", issued Jan. 18, 1951 (10¢ at GPO).

Protective lighting and emergency power are inherent considerations in plant protection principles (Protective Lighting Techniques, pp. 72-74, E. C. & M., May 1951). The electrical industry has been stressing protective lighting measures now for several months at local meetings before engineering and professional groups, at IES local meetings, and before trade and fraternal groups generally. Trade magazines have also been publishing many articles on the subject. But much guidance is still needed, if industry is to do this job, and do it right.

Building Controls

New curbs have been placed on building. NPA's May 3, 1951 amendment to their M-4 Construction Controls order expanded its previous permit system to require NPA approval for virtually all major construction, both public and private.

From now on, any project using more than 25 tons of steel must get license from NPA. The permit system had already been put into effect by NPA in the M-4 amendment of Jan. 13, 1951, when all new private commercial construction was made subject to specific NPA authorization. Subsequent to the January amendment, a total of 29 Regional and field offices have been set up to process and pass on these applications. These offices will take over the processing of these additional applications, covering "all factories or other public or private projects using more than 25 tons of steel . . . all apartments over 3 stories plus basement . . . all single-family luxury homes ($35,000 and above)".

M-4 was further amended May 11 to clarify provisions of the May 3rd order, and to specifically exempt construction of industrial plants, facilities or factories, for which a Certificate of Necessity has been issued.

Reason given by NPA for placing the building industry under nearly complete government control was to cut back production of structural steel —get more output of shapes and forms needed by the military. Builders, smarting under what they term a "mobilization straitjacket", are now lobbying for a top-level building coordinator.

CMP Programs

Defense Production Administration has formally established a Requirements Committee, whose function is described as "reviewing over-all demands for steel, copper, aluminum and other critical materials and recommending policies and programs for balancing supply with demand". This Committee, which will recommend the amounts of materials to be allotted under CMP, has previously been operating informally through inter-agency meetings.

Charles E. Wampler, Director of DPA's Office of Program and Requirements, was named chairman of the Committee, and Melvin L. Aushen, Assistant Director of that office, vice chairman.

The Requirements Committee and its sub-committees will be used primarily to assure comprehensive review of problems relating to the distribution of resources among the various civilian, industrial, foreign, military, and stock-piling requirements.

Price Controls

Inflationary pressures are expected to build up fast in the next six months. There will be less goods to buy, more income to buy with.

Military spending is now beginning to hit its stride. Outlays for the past twelve months are slightly under $20-billion. During the next twelve months (1952 fiscal year) they will about double.

Meanwhile, business will spend nearly $25-billion in 1951 on new plant and equipment—capital spending is at boom levels.

Impact of this combination—rising arms and rising capital spending—will be to squeeze civilian production down to 60-65% of last year's levels.

Consumer incomes, meanwhile, are steadily increasing. Total personal income in March was at $242.5-billion annual rate, up $23-billion over March 1950 rate.

To combat this inflationary pressure, Office of Price Stabilization is fast bringing all commodities and services under price ceiling regulation. If

it's all

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OPS Director Di Salle makes a fight of it, as he has been doing up to now in the face of opposition by strong pressure groups, he can probably hold the line for a while. But he's constantly on the defensive. If he is sucessful in at least slowing down the upward rush of prices, stalling off increases as long as possible, new production capacity is expected to bolster civilian supplies by late 1952 or early 1953, will aid in combating further inflation.

CPR-22, General Manufacturers Order, sets rules for ceiling prices at the manufacturing level for most electrical products: Lighting fixtures and equipment, building materials, radios, TV sets, small appliances, washers, refrigerators, etc.

CPR-34, Services, establishes method of determining ceiling prices for "services", defined as "any act or acts performed or rendered, otherwise than as an employee, for a fee, charge or other consideration". However, professional fees of engineers, doctors, lawyers and accountants are specifically exempted from ceilings by GCPR.

GCPR (General Ceiling Price Regulation), covers most commodities, products, services, etc., including certain foodstuffs, some industrial materials such as non-ferrous metals, rubber, sulphur and most chemicals, cosmetics, building materials at retail level, and many others.

Small Business Aid

DPA has announced a 31-page guide book, titled, "Mobilization Guide for Small Business", now available at all field offices of the Department of Commerce.

Designed to help the small manufacturer during the defense mobilization period, it provides a quick source of help to businessmen in locating services the Government is providing so that they can share, so far as requirements exist and their capabilities permit, in defense orders and in obtaining materials available to supply consumer requirements.

Residential Lighting

The demand for residential lighting fixtures will decrease during the remainder of 1951, NPA told the Residential Lighting Industry Advisory Committee at its first meeting held in Washington May 16th. This will result from the cutback in housing, showing its first slump in April. Housing starts in the first quarter were 260,000, with March starts totaling 95,000. April total was 88,000 starts. This left 1951 housing 65,000 starts below last year's total for the first four months. The year's total is still estimated at some 40-45% cutback of 1950 total of 1,400,000 starts.

The Committee members recommended steps be taken to get electric utility companies to accept low power factor ballasts as standard equipment in residential fluorescent lighting fixtures for the present emergency, to conserve copper and other critical materials needed for defense.

As a conservation measure, NPA urged residential lighting manufacturers, operating through their sales organizations, to encourage the turn-in of defective ballasts and old replaced lighting fixtures for salvage of copper.

Defense Bulletin

"Defense Production Record" is the title of a new weekly bulletin, now being published for DPA by the Office of Public Information, NPA, U. S. Department of Commerce. It is published to fill a need expressed by businessmen, trade organizations and news channels for a compact roundup of official actions taken by DPA and related defense agencies.

Each week this bulletin will summarize orders, regulations, recommendations of Industry Advisory Committees, and other activities of Government defense production agencies. It will be of business letter size and will contain from 16 to 24 pages. It will be free to newspapers and trade publications. Business firms and other organizations may get it for $2.50 a year from the Supt. of Documents, Government Printing Office, Washington, D. C. It will be mailed to subscribers each Friday.

Tungsten Shortage

About three-fourths of the world's supply of tungsten has been coming from Red China-dominated territory. With that supply cut off, tungsten is among the most critical of metals in the present defense period. It has thus been placed under price support, as part of a five-year program to encourage the discovery, development and production of domestic tungsten. General Services Administration will pay $63 per short ton for all specification-grade tungsten concentrates that cannot be sold on the commercial market. OPS has set dollars-and-cents ceiling prices (CPR-33) on ferrotungsten and other tungsten products. Manufacturers of tungsten filament light sources are feeling this pinch severely.

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DUPLEX RECEPTACLE: One of these double-duty outlets should be located on every 3 feet of usable wall space, or so that no point of a room is more than 6 feet from an outlet.

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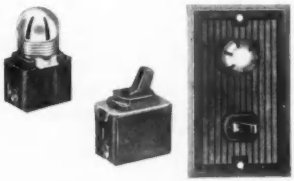

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And for the wiring devices, choose from our complete and varied line of quality, dependable, modern units. There's no finer source. Catalog on request.

Through messages like these, we're reminding architects of the importance of adequate wiring, and quality wiring devices, to everyone in the building field. Good Housekeeping Building Forum booklet "Electrical Planning in the Home" sent on request.

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Save equipment, fuse replacement costs, and production delays with Jefferson SAF-T-LAGS. Write today for the full story.

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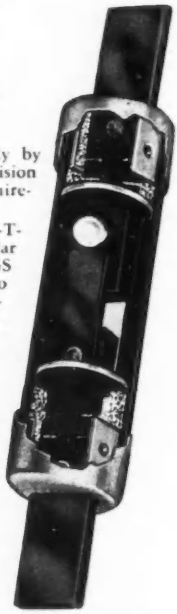

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Among the Manufacturers

Headquarters Announcements

General Electric Company, Philadelphia, Pa.—L. B. Gezon, sales manager, and O. A. Huntsman, assistant sales manager, Metal-Clad and Switchboard Section of the Switchgear Divisions.

The Yale & Towne Mfg. Co., Stamford Conn.—A. Charles Amann, general sales manager of the Stamford Division.

General Electric Supply Corp., Bridgeport, Conn.—I. P. Pruitt, manager of General Electric major appliance sales.

Victor Insulators, Inc., Victor, N. Y. —David E. Alexander, chief engineer.

General Electric Company, Schenectady, N. Y.—S. Vernon Travis, assistant general sales manager of the Large Apparatus Division; Louis H. Matthes, manager of sales for the Large Motor and Generator Divisions.

Delta-Star Electric Co., Chicago, Ill. —John Romano, general sales manager; R. S. Keeler, manager of Utilities Sales; W. H. Boyce, manager of the Industrial Division.

Skilsaw, Inc., Chicago, Ill.—Edwin B. McConville, executive vice-president; Paul Watts, vice-president in charge of sales.

The Black & Decker Mfg. Co., Towson, Md.—Alonzo G. Decker, president.

Century Electric Company, St. Louis, Mo.—R. N. Hill, vice-president in charge of operations.

Westinghouse Electric Corp., Lima, Ohio.—H. E. Grout, works manager of the Small Motor Division; W. P. Bell, manager of manufacturing; C. F. Herbold, superintendent of quality control.

Union Carbide and Carbon Corp., New York, N. Y.—Morse G. Dial, executive vice-president; Dr. George O. Curme, Jr., vice-president in charge of research.

Westinghouse Electric Corp., Pittsburgh, Pa.—E. W. Ritter, vice-president; E. V. Huggins, executive vice-president of the Westinghouse Electric International Company.

Kuhlman Electric Company, Bay City, Mich.—Daniel P. Lacock, assistant sales manager.

Morrison Steel Products, Inc., Buffalo, N. Y.—B. V. Ronco, chief engineer.

I-T-E Circuit Breaker Company, Philadelphia, Pa.—John W. May, chief engineer of the Switchgear Division.

Cannon Electric Company, Los Angeles, Calif.—E. C. Quackenbush, head of the engineering department of the new plant in the East Haven district of New Haven, Conn.

General Electric Company, Cleveland, Ohio.—William B. Gillen, manager of the East Cleveland Lamp Works at Nela Park; Henry F. DeLong, staff of the manager of the Lamp Manufacturing Division at Nela Park.

Regional Appointments

NEW ENGLAND

Cornish Wire Co.: Charles E. Scholl, sales representative for New England, except Connecticut.

MIDDLE ATLANTIC

The Esterline-Angus Co., Inc.: Robert F. Lamb, sales and service engineer for Western New York (Buffalo, N. Y.).

General Electric Company: Gomer F. Davis, manager of the Mohawk Sales District of the Lamp Department (Albany, N. Y.).

SOUTH ATLANTIC

General Electric Company: Paul M. Hooven, Jr., sales engineer and representative in Washington, D. C., of the Air Conditioning Department.

W. N. Matthews Corp.: J. A. Pollock, direct factory representative at Bainbridge, Georgia.

Graybar Electric Company: A. A. Wilson, manager of the Ashville, N. C., branch office.

General Electric Company: E. E. Hinson, sales representative in Washington, D. C., of the laminated and insulating products division.

EAST CENTRAL

Century Electric Company: William Helm, district sales manager of the new district sales office in Milwaukee, Wis.

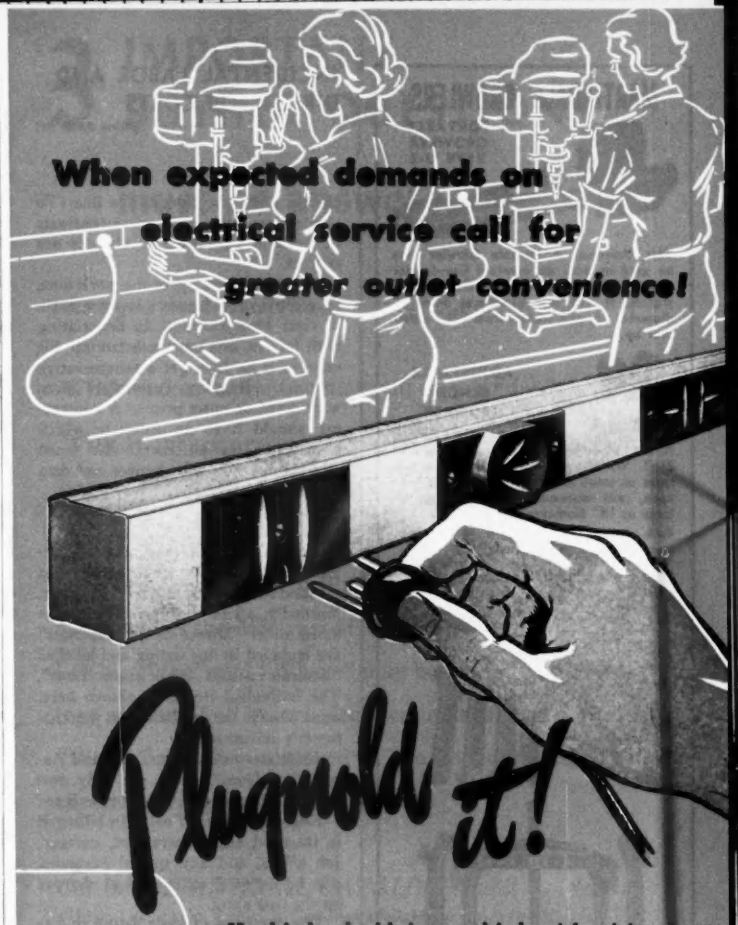
John A. Roebling's Sons Co.: Walter Whiting, Chicago district manager.

SOUTH CENTRAL

W. N. Matthews Corp.: B. H. McCoin, sales representative in Knoxville, Tenn.

WEST CENTRAL

General Electric Company: Dean M. Warren, manager of the Lamp Department's Midwest Sales District at Kansas City, Mo. (effective July 1).



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Both types available with or without meters. Also six other models.

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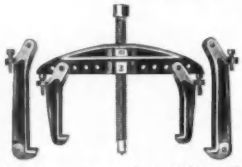

Adjustable arms pull straight without squeezing the work. Set screws prevent spreading.

Made in 2 Styles and 4 Sizes up to 24" diameter.

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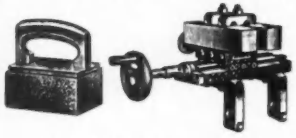

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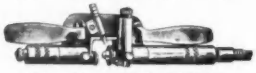

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INCIDENTAL LABOR AND DIRECT JOB COSTS

[FROM PAGE 69]

tractor must hue close to the line. To obtain the most remunerative contracts he must be sure that all charges are correct.

A large percentage of the work done by electrical contractors is some form of Cost Plus contract. In negotiating with buyers, one must substantiate his charges if he is to get a remunerative contract. Regular customers often want fixed or upset prices. A contractor should have an estimate which clearly depicts all costs. He must also stand ready with figures and data to substantiate any charges made.

Billing Labor

Table II presents a condensed listing of operating cost items designed to substantiate billing rates for labor. Normally, all of the first seven items listed under "Direct Labor Expenses" are included in one listing and labelled "Insurances and Association Dues". The individual items, as shown here, must always be available for the customer's information.

Aside from the "Insurances and Association Dues", there are only two other items of direct job expense listed —*Engineering* and *Tools*. In billing it is intended that supervision, cartage, job offices, and any special expenses, will be included as individual charges on the cost sheet.

The overhead expense listing in Table II is very much condensed, and may not always satisfy the buyer's demands. The contractor must be able to produce more detailed listings, similar to those provided in the previous article. Upon close study of this table, the reader will note that the overhead is not applied to the direct job costs. To compensate for this irregularity, the overhead percentage has been increased to approximately 2% above normal.

The figures are for the average cost of a $300,000 volume. With 100 separate contracts, the average would be $3,000. Curves show the overhead for a $3,000 project to be approximately 21%. A figure of 23% was used in this study.

The 2% differential can be justified as follows: Applying 10% (material overhead) to the $0.45 job cost produces $0.045. As it is, 2% was applied to the hourly rate of $2.50 and the result was $0.05. There is a $0.005 error, but the figures are only for the purpose of providing approximate costs to substantiate the correct billing.

Table III provides a listing of approximate costs (contractors') for labor per hour, where the base rate for mechanics is $2.35 per hour. The insurance rates used in preparing the values were the same as those used in Table II and other percentages of cost were practically the same. The tables of percentages in Table III can be used to substantiate charges for any base rate within 10% of $2.35, as the figures are only approximate.

Supply Detailed Costs

Costs similar to those shown in Tables II and III are not in themselves sufficient. Breakdowns for the individual items must be available. In Table II, 3% is included for tool costs. The contractor must be prepared to give a listing of the required tools and the estimated cost per month for each. He may even go further and provide comparisons between his charges and those authorized by the government for comparable tools.

Charges for engineering and other items must be justified by more detailed figures. The estimated time and rate per hour for engineering and drafting must be provided. And so for any item of expense, there must be detailed figures.

Very often buyers will not stop to study detailed figures. The fact that the contractor has them available will suffice. Customers are usually willing to pay for what they get, but want to know what they are paying for.

After a contractor has justified the charges for his services, he still has to enlighten the buyer on the values of such services.

FIRST RATE COMPETITION is the verdict rendered during session between (L to R) L. C. Rodgers, manager, Oregon-Columbia Chapter, NECA; and Portland contractors R. A. Montgomery, Montgomery Electric Co.; and George B. Schetky, Western Electrical Construction Company.

WHERE'S YOUR BREAK-EVEN POINT? [FROM PAGE 71]

Cost Item	*Percent of Sales*	*Monthly Cost in Dollars*
Direct Labor	22.5	$4,500.00
Material	47.6	9,520.00
Total Overhead	23.9	4,780.00
Total Cost	94.0	$18,800.00
Net Profit before taxes	6.0	$ 1,200.00

Note that these average larger businesses are operating well above their break-even point (80%), that a 20% drop in volume could be sustained before a loss is incurred, and that the net profit before taxes of 6.0% is well above that of the smaller shops and is above the average of all shops shown on Chart No. I where the break-even point was 87% of present volume.

Many lessons in business management could be drawn from the figures presented on these three charts. Let me emphasize again that this paper is concerned with the graphical method of presentation and analysis of operating figures rather than the actual figures used in the illustrations.

Analyse Your Operations

Let me recommend that you draw up a simple chart of the major operating figures of your own business and see how simply and graphically you can answer for yourself the following questions about your own business:

1. Where is my break-even point?
2. How much decrease in volume could I stand before I start to lose money?
3. How much could I improve my profits by a 10% increase in volume.
4. How much could I afford to spend in advertising and selling expense to increase my volume 10% or 20%.
5. What would happen if I cut prices 10% to try to increase my volume?
6. How much would I have to reduce my overhead costs to realize a fair profit on my present volume? On 20% lower volume?
7. What percent reduction in labor costs would accomplish the same result? How much could I afford to spend on new labor- and time-saving equipment?

Many other similar questions which are or should be in your mind continually can be easily and simply answered by the graphical method here presented. We recommend the method for your serious consideration.

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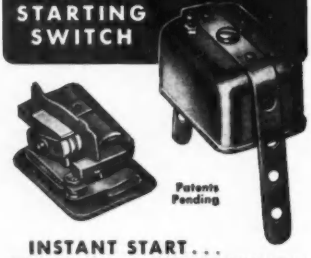

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WIRING A SMALL PLANT FOR ADEQUACY [FROM PAGE 67]

installed at 24-foot mounting height on 20 ft. by 26 ft. spacing. The machine shop, occupying a partitioned area in the center bay section, uses the same reflectors on the same mounting height and spacings, but the units are equipped with 1500 watt lamps, and supplemented with 500 watt angle reflectors in the corners of the bay areas.

North and South lean-to areas are lighted with a single row of 1000 watt RLM dome reflectors installed near the slanting ceiling of the 25-foot wide area, providing an intensity of 10 to 15 footcandles.

Intensity in the center bay is 10 footcandles general average, with 25 to 30 footcandles in the machine shop area. The high bay areas are lighted to an intensity of 10 to 12 footcandles average by the mercury vapor lamps.

The workmen have expressed a preference for the mercury vapor lighting. They state it eliminates harsh reflections from work surfaces, permits closer inspection, and even shows up the hammer marks made in the steel.

In the template shop, 50 footcandles of illumination is provided by nine continuous rows of two-lamp 40 watt units, spaced on 9 ft. 4 in. centers. Rows are installed on Unistrut.

General illumination ranging from 30 to 60 footcandles is provided in most office areas, using fluorescent standard 40-watt and slimline lamps. Stairways and corridors are lighted with incandescent.

The general plant office, drafting room and chiel engineer's office are lighted by rows of two 4/40-watt units placed end to end. Spacing in general plant office is 12 ft. 6 in., providing 65 footcandles. Rows in drafting room are on 6-foot centers, giving a level in excess of 100 footcandles average and up to 150 footcandles on the drawing tables.

Oberg Electric Co. of Salt Lake City was the electrical contractor, and M. E. Dansie, the contractor's electrical engineer, designed the circuits and the shop main and accessory building lighting. C. J. Vacher chose and located the lighting fixtures in the plant office building. Scott & Beecher were architects on the plant office building, all of Salt Lake City. The owners, Chicago Bridge & Iron Co., designed the plant arrangement as well as the shop structures and accessory buildings.

REMOTE CONTROL CIRCUIT SAFETY [FROM PAGE 80]

grounded bus, as shown in Fig. 4. The reason for this was explained in preceding articles and such a connection is recommended in a fine print note of paragraph 4373 in the 1951 National Electrical Code.

Referring again to paragraph 4374 of the Code, we find the requirement for the relay shown at R in Fig. 4. Actually, the disconnect switch for the control circuits is not adjacent to this controller as shown—it may be in another room at the control console or panel. So, each controller must have a small relay with its solenoid fed from the load side of its disconnect switch, as shown in Fig 4. Thus, you can see that all ungrounded supply from the external control circuits will be disconnected when the motor disconnect is open.

Multiple Contactors

Instead of the simple contactor shown in Fig. 4 the controller for a certain motor may consist of a group of contactors for automatic speed control, compensator start, reversing, etc. The mill in Fig 2 would probably be started by an automatic compensator. The relay shown at R would still be used in the same manner, with the exception that it might require more contact arms or poles to disconnect other external control wires concerned with reversing operations, etc.

There is one exception to the need for this relay at each controller compartment. The exception is where a group of controllers are served from a single disconnecting means as permitted in paragraph 4410 of the Code In this case, the control circuit for the group must be fed from the load side of the single disconnecting means or a relay must be connected as shown at R, to disconnect the external control circuit from this group of controllers, upon opening the single disconnecting means.

Provision for Baffles

This is a good place to mention that where several controllers are mounted close together in one compartment, baffles must be provided between them, unless they are all disconnected as a group by one disconnecting means. The baffiles are to prevent accidental damage to equipment and injury to a person working on a controller while adjacent ones are energized. These baffles may have gaps at their intersections

to allow passage of connecting wires.

We have one more major consideration and that is indicating or pilot lights, to show when the equipment is operating. They usually consist of green and red; to show green when the motor is running and red if it is off unexpectedly (the opposite of usage with high voltage circuit breakers—where red indicates closed and green open).

Pilot Lights

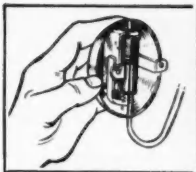
One lamp may be used to indicate only if the motor is running, but this lamp may burn out without the operator being aware. If both red and green are used, he will have a better indication of the state of affairs and can assume a lamp is burned out if none is showing. In this connection, voltages should be chosen for solenoids and lamp so that solenoids operate on a voltage slightly below the recommended operating voltage of the lamps. The lamps will have long life at reduced voltage and still provide ample light for the purpose.

Where separate control circuits are interconnected, as depicted in Fig. 3, there is not so much need for pilot lamps. If there is no pushbutton station used and only a simple control circuit loop from 1 to 4 (see Fig. 3), the auxiliary contacts at H are abandoned. Thus they can be used to control the pilot lamp as illustrated in Fig. 4, where the lamps are shown at P. If two lamps are used the controller manufacturer can usually supply two sets of auxiliary contacts, as shown.

Control Center Indicators

Some designers will station the pilot lamps at the control center and operate them from the control circuits instead of from the motor controller. This avoids the need for runs of wire back from the auxiliary contacts to the lamps. On the other hand, if the running-overcurrent relay tripped the controller open the pilot lamps would not so indicate, as this would not alter their source of supply.

We have covered in this article, only the elemental use of the component parts to a complex system and it must be apparent to the reader that there are many ways of putting these components together, so far as connections are concerned. Many designers will cut a lot of corners but we may have helped the reader to understand the intents and needs to be satisfied, as he orders such equipment or designs it for his own use.



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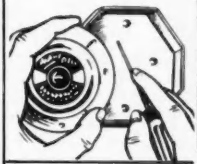

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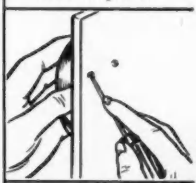

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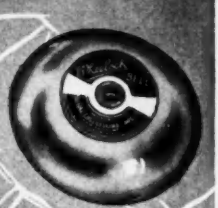

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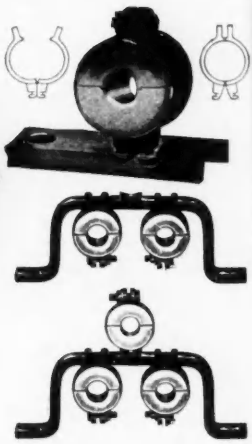

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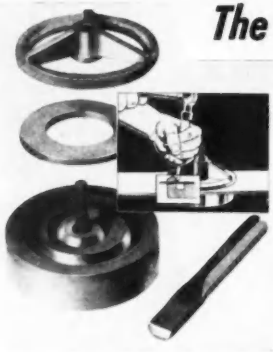

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SELF SERVICE DISTRIBUTION

[FROM PAGE 73]

amp 220-volt and one 400-amp 440-volt 3-phase duct flank each of the two structural paths. The fifth busduct is a 225-amp 110-volt single-phase run that bisects the plant. Plug-in branch circuits extend from these ducts to power centers and, in the case of the 110-volt duct, to lighting panelboards.

All feeders are controlled at the main switchboard by vacu-break disconnects, and ground-leakage detectors on the main 220- and 440-volt lines indicate by means of flashing lamps any grounds that may develop. Location of faulty equipment is fast and positive, for detectors flicker only during the operation of grounded welders and machines, and matching these flickers with operation cycles of individual pieces of equipment is a simple visual task. Since 440-volt welders are single-phase and 440-volt service is 3-wire 3-phase, branch taps to progressive distribution centers are staggered between phase bars so that a balanced loading results.

Another important feature of the power installation is its salvability and portability so that, if another move to larger quarters is eventually necessary, the busduct runs, switchgear and self-service centers can be dismantled and reassembled without harming the equipment. Under present conditions, with material scarcities growing more acute, this is a major consideration.

Lighting in the factory area is provided by Holdenline plastic-sided 2-lamp 8-foot slimline units, chain-suspended end-to-end in continuous runs on 10.5-foot centers at a 10.5-foot elevation. The maintained illumination level is an even 40-footcandles.

Reviewing the installation, President Glezen sums it up by stating, "We have found that modern distribution and planned lighting is paying dividends in the form of higher productivity, efficiency, safety and morale.

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New Ads Received by June 22nd at the New York office, 330 W. 42nd St., New York 18, N. Y., will appear in the July Issue subject to limitations of space available. E.C.M.

NEW Air Cooled
TRANSFORMERS

• WILL OPERATE ON 240, 480 and 600 Volts

All transformers insulated with fiber glass; no fireproof vaults required. For lighting and power.

★ LOW PRICES ★

KVA	VOLTAGE RATING
¾ to 25	450 to 117
3 to 25	225/450 - 117/234
3 to 25	600 to 120/240
PHASE CHANGERS	
6 to 50	220 or 440 to 220

MANUFACTURED BY ALLIS CHALMERS

• *Crated for immediate delivery*

AMERICAN ELECTRIC SERVICE & MAINTENANCE CO.
SPRINGFIELD, MASS.
MOTORS ● GENERATORS ● TRANSFORMERS ● SALES ● REPAIRS ● RENTALS

WE OFFER FOR SALE
Immediate Delivery

1200—¼ H.P. General Electric Motors Totally Enclosed, Ball Bearing 220 Volts, 3 Phase, 60 Cycle, 1140 R.P.M.
800—½ H.P. General Electric Motors Totally Enclosed, Ball Bearing 220 Volts, 3 Phase, 60 Cycle, 1725 R.P.M.

All motors brand new and in their original cartons

All Orders Subject to Prior Sale

DEXDALE HOSIERY MILLS
Lansdale, Pa.

WIRE

720' 1/0 Stranded, 3 conductor, 19 strands twisted, Class 38 insulation, 5/64 GRS, 3 conductor with Bus drop on ground, loom sheath, marked 600 volt. GE Loom Sheath Insulated Cable.

15—150' lengths New GE 8-3 BX

IN STOCK:
Transformers, Motors, Generators, Gear Reducers, Switches.

CROWN MACHINERY COMPANY
2323 No. Ninth St. St. Louis 6, Mo.
Central 1313

MOTORS, GENERATORS, TRANSFORMERS

1—1500 H. P.
Bought and Sold New and Rebuilt
ELECTRIC EQUIPMENT CO.
ROCHESTER 1, N. Y.

ELECTRICAL CABLE

- for every industrial and power application.
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular suppliers.
- Cut to length. Reasonably priced.

UNIVERSAL Wire and Cable Co.
2664 N. Clybourn Ave. Chicago 14, Ill.

Simple as A B C

Handle heavy reels easily and safely; remove wire or cable from top or bottom, front or back of reel with

ROLL-A-REEL

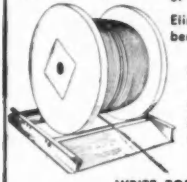
Style A: 2,000 lbs. cap. 37.50

Style B: 4,000 lbs. cap. 75.00

F.O.B. Cincinnati

Low slanted front and positive front lock insure quick loading or unloading.

Eliminate jacks, cumbersome handling.



Carried easily to reels, job or storage.

Sold through wholesalers only.

WRITE TODAY FOR DETAILS

ROLL-A-REEL
327 WEST FOURTH STREET
CINCINNATI 2 OHIO

WHERE TO BUY

Equipment, Materials, Supplies and Services for Electrical Construction—Maintenance — Repairs

WODACK "DO-ALL"
ELECTRIC HAMMER

A power tool of many uses for electrical contractors and plant maintenance work. Hammer is detachable from drill member. Drills concrete ¾" to 1½" diameter, metal to ⅝" and wood to ⅞". Forged hammer tools for chipping, channeling and cutting masonry materials. Attachment for right angle drilling.

Ask for BULLETIN 485-EC

Wodack Electric Tool Corp.
4627 W. Huron St. Chicago 44, Ill.

New Advertisements

received by June 22nd appear in July issue, subject to space limitations.

Address copy to the Classified Advertising Division
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330 West 42nd St., New York 18, N. Y.

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NEW FRACTIONAL H.P. MANUAL STARTER HAS *ALL* THE FEATURES!

right:
Class 2510
Basic Starter Mechanism

DESIGN LEADERSHIP IN THESE FEATURES:

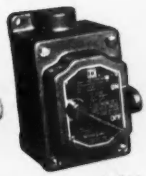
- ✓ Quick-make, quick-break contact mechanism
- ✓ Single or double pole construction
- ✓ Double break contacts of fine silver
- ✓ Modern styling
- ✓ Straight-through wiring with convenient terminals—generous wire space
- ✓ Dependable melting alloy type overload protection—trip-free
- ✓ Definite trip indication
- ✓ Interchangeable overload relay units accessible from the front
- ✓ Open type starter can be used with standard switch box and flushplate

a Variety of Enclosures

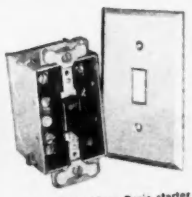
General purpose enclosure—with or without pilot light

Water-tight and dust-tight enclosure

Water-tight and dust-tight with pilot light



Explosion-resisting enclosure. For hazardous locations—Class I Group D and Class II Groups E, F and G.



Flush mounting. Basic starter mechanism can be used with standard switchbox and flush plate — or with flush plate only for machine tool cavity mounting.

RATINGS

Double pole
1 H.P., 115-230 volts A.C. or D.C.

Single pole
1 H.P., 115-230 volts A.C. and ½ H.P., 115-230 volts D.C.

Write for Bulletin 2510A. Address Square D Company, 4041 N. Richards St., Milwaukee 12, Wisconsin.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S. A., MEXICO CITY, D.F.

CONSIDER THESE

4 G-E WIRING FACTS

FOR TODAY'S ELECTRICAL REQUIREMENTS

1. Q. *HOW CAN YOU SPEED INSTALLATION OF NEW POWER AND CONTROL CIRCUITS IN LIGHT INDUSTRIAL AND COMMERCIAL BUILDINGS?*

A. Use G-E electrical metallic tubing. This lightweight, thin-wall tubing speeds installation, because it's easy to handle, easy to bend, and easy to install.

2. Q. *WHY IS THE G-E REMOTE-CONTROL WIRING SYSTEM PARTICULARLY SUITABLE FOR INDUSTRIAL AND COMMERCIAL BUILDINGS?*

A. G-E remote-control wiring makes multipoint switching economical and easy to install. Small, lightweight control wires save space—can be placed practically anywhere—stapled to wall surfaces, laid up on partitions. These wires can be moved easily as partitions and floor layouts change.

3. Q. *WHAT IS THE BEST PROTECTION FOR MACHINE TOOL LEADS THAT ARE SUBJECT TO VIBRATION?*

A. G-E flexible steel conduit is ideal for machine-wiring installations. This tough raceway can be hand-shaped around obstructions where space is limited. It stands up under severe operating conditions where motors and other equipment cause vibration.

4. Q. *HOW CAN YOU CUT INSTALLATION DELAYS WHEN YOU EXPAND POWER DISTRIBUTION IN INDUSTRIAL BUILDINGS?*

A. G-E Varnished-Cambric Interlocked-Armor cable—carrying its own flexible raceway—presents no complicated installation problems. This ready-to-install cable can be bent around obstructions, pulled in long runs, laid up on existing beams, or installed on racks.

General Electric Construction Materials Department at Bridgeport is headquarters for wiring progress

Through constant research and precision manufacturing methods, the G-E Construction Materials Department sets the pace with modern and high-grade materials.

Through distributors in every locality and specialists in the local G-E offices, the G-E Construction Materials Department offers you complete services on any type of wiring problem.

For information on any G-E wiring material, contact your local G-E Construction Materials distributor, or write Section K56-618, Construction Materials Department, General Electric Company, Bridgeport 2, Conn.

You can put your confidence in—

GENERAL ELECTRIC